Evolution of Communications

APRIL 1953

# ARMY INFORMATION DIGEST

## *In This Issue:*

PRACTICAL POINTERS in logistics—the art of planning and carrying out military movement and supply—are spelled out by the Assistant Chief of Staff, G4, in "Commanders Must Know Logistics." Drawing on his experience as VII Corps artillery commander in World War II and as commander of X Corps in Korea, Lieutenant General W. B. Palmer shows how "the dull but decisive business of logistics" is magnified to crucial proportions when supply lines are extended to oversea combat zones. The commander's relation to his G4 and supply services is also summarized.

MORE THAN A FORMAL KEYNOTE of a new administration, President Dwight D. Eisenhower's inaugural address clearly sets forth the articles of freedom's faith—the creeds and tenets which form the moral basis for a dynamic approach to our world responsibilities. "We must be willing individually, and as a nation, to accept whatever sacrifices may be required of us. A people that values its privileges above its principles soon loses both," the President declares.

KNOW YOUR WEAPONS HISTORY. The machine gun on the front cover dominating the approaches to a river crossing in Korea is actually the evolutionary end-product of the sling, bow and arrow, catapult and missile launchers of bygone days. Techniques have been refined but the basic principles of inflicting a mortal wound on the enemy remain essentially unchanged. In a series beginning in this issue, a leading authority on weapons development relates how man's inventiveness has transformed the technology of war "From Clubs and Spears to Automatic Weapons."

A MEMORABLE MOMENT in history is captured in the National Archives photograph on the back cover. Speaking before an audience of Supreme Court Justices, Cabinet members, Senators and Representatives on the night of 2 April 1917, President Woodrow Wilson delivered his epoch making request for a declaration of war against the Imperial German Government. In phrases echoing into history, President Wilson called for a war "without rancor and without selfish object" —a war "for democracy, for the right of those who submit to authority to have a voice in their own governments, for the rights and liberties of small nations, for a universal dominion of right by such concert of free peoples as shall bring peace and safety to all nations and make the world at last free." For many years, 6 April, the anniversary of the declaration of World War I, was observed as Army Day. In 1950, it was superseded by the observance of Armed Forces Day in May.

OTHER APRIL ANNIVERSARIES include the outbreak of the Civil War at Fort Sumter (1861), the Revolutionary War at Concord and Lexington (1775) and the Spanish-American War (1898). On 30 April 1790 the first general organization of the Army under the Constitution, provided for an Army consisting of one regiment of infantry and one battalion of artillery, for a total strength of 1283. The Coast Guard was organized on 4 April 1790 and the Navy Department on 30 April 1798.

HOW THE LARGEST TECHNICAL SERVICE in the Army achieves significant economies through a four-fold program of Standardization, Substitution, Simplification and Salvage-Rebuild is detailed in "Ordnance Serves by Saving."

AN INDEX to 1952 DIGEST issues is now available for free distribution. Requests indicating the number of copies desired should be addressed to The Editor, ARMY INFORMATION DIGEST, Fort Slocum, New York.

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U. S. Army Photograph

LIEUTENANT GENERAL W. B. PALMER

# COMMANDERS MUST KNOW LOGISTICS

LIEUTENANT GENERAL W. B. PALMER

I THINK that most of the men of my generation who have become generals from the combat arms found our life-long interests in the G3 field and did our best to duck the other General Staff sections. There was a prevalent idea that G3 was the "command" element of the General Staff and that the other General Staff fields belonged to specialists.

One need not look far to find the historical reason for such an idea clinging about the subject of logistics. For centuries the generals were invariably noblemen to whom logistics was a low business for merchants. They would no more have stooped to such work than they would have permitted merchants to encroach on the noble business of generalship. It is true that some great commanders like the Dukes of Marlborough and Wellington were extremely careful about their logistic arrangements, but their example was not much imitated.

Then too, logistics used to be a lot simpler than now. English law for many centuries required every man between sixteen and sixty to answer the call to arms, provide his own weapons and equipment, and *maintain himself in the field.* The colonists brought this logistical doctrine across the Atlantic, and it was translated into United States law by the Act of 1792, which required every man to answer the call to arms, furnish his own arms and equipment, and—if appropriate—his horse. This law of 1792 remained on the books until 1903. General Grant at Appomattox allowed the Confederate officers and soldiers to keep their horses because they were private property.

But in modern wars, and particularly in war as waged by the United States—oversea wars with dependent allies—it would be very unwise for any officer who is preparing himself to be a field commander, to brush over his study of the dull but decisive business of logistics, thinking that some specialist will

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look after it for him. A general does not know the facts of life, he is just playing cowboys and Indians (and I have seen not a few who were), until he has a clear and lively *appreciation* of his logistical situation and knows how to get and stay ahead of the game logistically. So let us consider some of the facts of life.

### *Pressure for Premature Offensives*

Now the first fact of life, I should say, is that neither the public, nor the press, nor most of the great statesmen, nor indeed some of the top planners, ever want to allow time to build up logistically for the victories they crave. The public and the press want offensives and victories right now, while many civilian leaders, and invariably some military leaders as well, live in a dream world where wars are won merely by drawing huge arrows across deserts, mountains and seas. Do you remember the important people who announced on 8 December 1941, that we would start to Japan right now and settle their hash? The logistics of a Pacific war escaped them completely.

And then there was the immense pressure to open a second front in Europe. Some people advocated assaulting Hitler's Europe in 1942, although it seems to me the evidence is plain that it could not have been done without ships and landing craft and DUKWs which did not exist until two years later.

It may seem that I have strayed from my subject, that the problems of a corps commander are a long way below the top level of a command. But usually it is a force the size of a corps or even a division which in the end has to face the consequences of these top-level blind-spots; and every general holding a command, however small, always holds the bag of responsibility.

### *Total Responsibility of a Commander*

The second fact of life is that when you become a commander, your superiors expect you to look out for yourself in every respect imaginable. When I say this, it sounds like the most obvious of platitudes. But the truth is that some commanders fail to consider the immense range embraced by the phrase "every respect imaginable."

We see readily that a commander must handle his own fight and bring it to a successful outcome. But I am afraid a good many commanders fail to appreciate that they are equally on their own in logistic matters. They seem to think somebody else looks after all that. The moss-grown maxim that

the impulse of supply is from the rear is a fine one for the Services of Supply, but any field commander who lets it go at that will be ruined in no time. When you are a commander, you are expected to look after yourself. Commanders are selected on the precise basis that they *can* look after themselves; and when your superiors really admire and trust you, they not only count upon you to look after yourself 100 percent but they also have confidence that, in so doing, you will help them to look after the show as a whole.

I want to emphasize, coming from several years of command, that in my opinion a commander's proper job includes taking the lead aggressively in getting his superiors to attend to his needs in a timely fashion. It means that he is dominating events and doing his own thinking about every imaginable aspect of his responsibilities. And I want also to emphasize that, in practice, the matters in which you have to push your superiors are at least 90 percent logistical. Let me give a few examples of this philosophy at work.

In 1944, when I was Artillery Officer of the European Theater, I initiated a request that a very considerable number of battalions of 155-mm. howitzer artillery, being formed in the United States, be changed to 8-inch howitzers. Neither I nor anybody else in Europe had ever seen this brand-new gun. My action had to be based on very uncertain information. The War Department received the proposal with warm delight and approval, the artillery and ordnance experts in the zone of the interior said it was just what they were hoping for—but nobody gave us a hint to that effect until we had made the request. The policy was to let an oversea commander run his own show—and the application was that rigid.

Early in 1951, while I was commanding the 2d Armored Division, I began to see a great deal in the papers about sending four divisions to Europe. Speeches by high personages hinted that two divisions would sail before July first. I could hardly figure any way that the 2d Armored Division could fail to be one of those two, and made all plans accordingly, but not a word of official instructions came from Washington. When I had waited as long as I could without getting behind time, I wrote a personal letter to the Deputy Chief of Staff, and asked if I might be given official guidance. A conference was immediately arranged in Washington to give advance instructions to my Division and to the 4th Infantry Division as well.

People were brought from Europe to participate. From then on, everything was on the track.

Now please understand that I am not criticizing the Department and saying that it had overlooked this problem; on the contrary, I am praising what it did for me. My superiors were entitled to expect me to take all actions necessary, and in such good time, as to insure that my Division would be able to carry out any mission it might receive. Accordingly my action was well received and ample results flowed from it.

Both of the examples I have given—the artillery in 1944 and the movement of the Division in 1951—were essentially logistical.

Thus far I have mentioned two facts of life that must affect the field commander's thinking about logistics. Those are, first, that some members of the public and the press, many of the great statesmen, and even some of the top planners, live in a dream world where logistics impose no delay on early offensives and prompt victories; and second, that your military superiors rightly expect you to look out for yourself in every imaginable aspect of your responsibilities, and help them to run the big show as well.

### *Our Policy of Oversea Defense*

To me the most important of all the facts of life, however, is the fact that the United States has based its first line of defense overseas. I think that there is nothing upon which a more overwhelming majority of the American people agree. Millions of Americans have seen for themselves the destruction of modern war, and are determined to contain an aggressor before he can loose destruction upon our own country and the other freedom-loving nations of the world. Franklin D. Roosevelt once had to deny having said that our military frontier was on the Rhine, but thirteen years later we are telling the whole world it is. We were not sure just where our other military frontier was until the Communists invaded South Korea, and then we decided very quickly.

Well, then, if we are going to be ready to fight overseas, every commander has to prepare himself to cope with beachhead supply; and with military ports; and with the utilization of indigenous labor from the water's edge to the front line; and with organizing, equipping and training indigenous troops; and with feeding the population; and with providing locally for the repair and rebuild of his worn-out military equipment;

and eventually with rebuilding the railroads, highways, wire communications and public utilities of a foreign country.

You may say that a corps command, for instance, does not have to bother with such things but you will be badly mistaken. Most oversea operations begin with a division or corps-sized task. Do not count on being commander of some slow-poke unit which will not arrive in the battle zone until after the pioneers have straightened everything out. General Dean and General Almond in Korea, General Patton in Morocco, General Graves in Siberia in 1918, Shafter in Cuba, Miles in Puerto Rico, all the way back to Winfield Scott in Mexico—all of them had the equivalent of a division or corps-sized command when they opened a new combat zone on foreign soil.

Let me give you a few examples of the sort of thing that can go wrong.

In 1942, certain artillery units landed with their guns in Africa, only to find that their boxes of sights, quadrants and accessories were on another ship which had returned to the United States without unloading. The commanders of those units must take the blame, no matter how many transportation officers interfered; the commanders had allowed their units to become useless. There have also been cases in recent years in which artillery units landed in a combat zone to find no ammunition of their caliber anywhere in the theater; that could hardly be blamed on the unit commander.

In every war there is a dreadful howl about artillery and mortar ammunition. As an artilleryman, I am all for using plenty of artillery and mortars to save the lives of the infantry. I spent the whole of World War II convincing infantry and tank commanders that it was the smart thing to do. At the same time, I was well aware that the United States could not provide all the ammunition I wanted. We have to share the steel with the Navy, the Marine Corps, the Air Force and the Merchant Marine. We also have to build bridges, railroads, depots and air bases in countries 5000 miles across the oceans. You cannot build your battle techniques on dreams of *unlimited* artillery ammunition. The field commander simply *must* know the ammunition situation for each major operation, or he is practically certain to run short just when it hurts the worst.

These artillery problems, however, are very small compared to some really gigantic ones which clearly demonstrate that the training of future commanders should include a more solid foundation in the logistics of conducting war on the far side

of the ocean. The things I am going to mention now reflect this need very seriously, especially in the matter of opening beach-heads on foreign shores.

Repeatedly in World War II, supplies were landed in such an excess of tonnage over the capabilities of the local logistic organization to cope with it, that pretty soon many things could not be found at all. The next thing, the zone of the interior had to rush out a special shipload of something which was right there in the theater—and always at a time when ships were worth their weight in gold. Soon the war moved on and supplies were left behind, which are still being gathered up and sorted out to this day.

Two years after the Korean War started, I visited Pusan. They had been working hard, and by that time they had sorted out probably 75 percent of the supply tonnage there. Twenty-five percent of the tonnage on hand was not yet on stock record and locator cards; they did not know what it was or where it was. I think that is approximately correct.

In Pusan I saw another example of what happens in oversea wars. It was really impossible to check accurately what was unloaded from a ship, because the native Korean tally-men listed many boxes of "This Side Up" and many more of "Handle With Care."

General LeRoy Lutes once told me that in 1942 he visited a South Pacific port where he found seventy-five ships lying at anchor waiting to be unloaded, while the rate of unloading was four ships a week—this at a time when shipping was desperately scarce. The commander concerned was doing the best logistic job he knew how according to the training he had received, and the challenge is that hereafter his training should be such as to prevent him from making such blunders. We must modify our professional standards and train our future commanders so that they can balance what they insist on having with what they actually need and can handle when it gets there.

### *Support of Dependent Allies*

The American policy of establishing its defense line overseas has a vastly important corollary. You always have to provide logistic support for dependent allies.

When I commanded X Corps in Korea, I had the Turks, Colombians, Filipinos and Ethiopians, but all of them were logistically assimilated into United States divisions by that

time, and no important logistical problems arose at Corps. But the Corps was deeply involved with six different kinds of Korean personnel, and each kind was on a different supply status.

First there were complete Korean divisions; then part of my Corps troops belonged to the Republic of Korea Army; third, I had a Korean Service Corps division, which was composed of civilians under a ROK Army cadre; fourth, National Police units; fifth, a hush-hush Intelligence outfit; and sixth, a large number of Koreans serving right in our own United States infantry companies and artillery batteries. These six kinds of Koreans involved five different rations and uniforms.

When you give an ally modern weapons and equipment, you are up against maintenance and parts supply. The long period of static warfare in Korea has given us time to accomplish a great deal among the Korean combat units. Repeated command inspections have been valuable in bringing the Korean commanders and their staffs and technical services to improve their maintenance and to overcome that hoarding instinct of hiding weapons and ammunition and then asking for more. ROK division commanders soon began to keep equipment status charts in their war rooms—making their G4's keep the record in plain sight. The percentage of deadlined vehicles came down in a steady improvement. Just before I left, my Corps Signal Officer told me that the ROK units had their signal equipment in better shape than did the United States Army units.

As a Corps commander I went again and again to everybody above me to get a decent flow of spare parts for the old Japanese trucks used by the ROK Army, and to get complete kits of vehicular tools and artillery tools for the ROK ordnance companies. They were getting good mechanics but lacked the tools and parts to do their jobs.

There was also a constant problem whether the ROK ration was sufficient to keep the men in health. Their money was so inflated that division commanders could not buy the necessary food to supplement the rice which was issued in kind.

A corps commander finds himself putting plenty of his personal energy into logistical problems in this sort of situation. And since it is certainly a fact of life that we may have to fight overseas, all commanders of United States forces will find themselves coping with the support of dependent allies.

Logistic lead-time is another serious fact of life which faces every commander.

Nearly always, the most desirable strategic decisions are

constricted by logistical conditions for which there is no early remedy. Acute shortage of ocean shipping must be regarded as a normal logistical handicap in embarking on an oversea war. The first problem is how to get to the war area at all.

The over-all logistic situation at any given time is very largely a result of what looked like a good idea three, four or five years ago. If a commander asks suddenly for some weapon or equipment which is not in production, he will not get it for probably two years; and if he merely decides that he wants more —or less—of something which *is* in production, it may take four months before any change appears in the flow of supplies.

When the field commander decides to add Koreans to his United States units, or to form some new tank units from stocks in his depots, he must move with precision to tidy up the situation back through the pipeline. If you start to feed, clothe and equip 15 percent more than your United States troop ceiling, you had better make sure that the zone of the interior is prepared immediately to pick up the added requirements and to ship accordingly.

Or if you decide to convert some tank units from M4 to M48, using stocks in your own depots, you should realize that those stocks represent your battle consumption factor for the units you already have, and make sure that the zone of the interior not only replaces the tanks you took out of stock, but also alters your troop basis and increases the automatic shipments for consumption.

Let me give you another story about lead-time. In London, one day in January or February 1944, one of our greatest generals told me that our M4 tanks must have half of their ammunition in the form of white phosphorous shells for the invasion of Europe. He said they had burned up lots of German tanks with white phosphorous shells in Sicily, and anybody in the 2d Armored Division could tell me about it. I think we were then manufacturing about 5 percent white phosphorous shells for the M4 tank, and little could be done about it for many months, but I went at once to the 2d Armored Division to get the story. The commanders all assured me that it was quite true—they had really paid off in Sicily, setting German tanks on fire with white phosphorous.

I then asked them for detailed accounts of some actions in which this had occurred, giving the facts with all possible exactitude. Ten days later, I was told that they had been unable to find a single tank soldier or tank officer who would

claim to have set a German tank on fire with white phosphorous shells. What they did find was one case in which an "assault gun" (which was a light tank carriage armed with a 75-mm. mountain howitzer of low muzzle velocity) had been shooting white phosphorous at a German tank which broke into flames. The gunner said very honestly that a lot of things had been firing at the German tank and he did not know whether he or somebody else set it on fire. Evidently some onlooker saw the white phosphorous burst just before the tank started to burn; and from his story the thing had grown, until one of the greatest tank experts in the world wanted me to change the whole production of tank ammunition right now. This incident certainly taught me a profound lesson about getting the facts.

### *Supply Discipline of Troops*

These, then, are what I call the facts of life, and up to now they have been the sort of thing you ought to know so you will not get into trouble. But we come now to something right in your own outfit, and that is the *certainty* that your troops will become negligent and wasteful in supply and maintenance unless you are very determined about it.

Every experience in my life supports that statement; you can be certain that it will be true. Every commander must jump into supply discipline with speed, vigor and persistent follow-through.

In Korea I had occasion to inspect an American infantry regiment. First I gave them time to put in requisitions and replace their shortages. Only after that did I make my command inspection. To give you only one example, I found that too many of the crew-served weapons did not have their proper accessories and spare parts. Nobody from top to bottom held anyone responsible for such things. One outfit had four recoilless rifles with three sights, two quadrants and one rammer staff. All machine guns were similarly deficient.

It appals me to think how many failures occur in this very last link of the logistic chain. Equipment is manufactured at great expense. It is shipped 5000 miles by train, ship and truck. It is issued to the troops and eventually, with great labor, carried to the top of a mountain in Korea. How many times, at that last point, has this whole enormous effort been thrown away, as carelessly as a burnt match, by the happy-go-lucky negligence of the very people whose lives depended on their keeping the stuff in shape?

If a commander has an eye open for waste and neglect of equipment as he goes about, he may at times feel despair about improving the situation; it appears so universal and shows up in such a myriad of ways.

But the remedy is not too difficult, provided the commander himself is a determined man and really means business. He makes his senior technical service officers get around actively and come home with specific reports of bad conditions. He also makes them give him comparative charts which show the most backward units. In other words, he gets the facts; that always comes first. He then speaks personally to each commander who appears to be falling behind in any respect. He can do this in the most friendly way. It is not the abusive tone which arouses your subordinate; the simple fact of your interest in the matter makes him jump.

I also believe firmly in command inspections. They are a great help to your subordinate commanders, who are younger and less experienced than you. The younger commander accompanies you and as your practiced eye brings out defects, and as your candid comment "Unsatisfactory" rings in his ears, he learns more in an hour than all the tons of mimeographed gobbledygook put out by your staff could teach him. The same thing is accomplished by each of your senior staff officers as he accompanies his opposite number through the inspection. A command inspection is hard work but it is a great educator and should be so conducted. You always learn a lot yourself and finish with a feeling of accomplishment.

### *The Commander and His G4*

That brings me to the commander's relation to his G4 and his supply services.

What is our American concept of the function of the General Staff? It is to assist the commander in doing everything which, if he had supernatural powers, he would do himself as part of his own job of command. This is our doctrine on the subject, and accordingly it is impossible for any commander to dismiss the G4 function as something to be done by a specialist. It is an integral part of the function of command. It is also our General Staff doctrine not to take direct charge of matters which are *not* a part of the commander's own job, such as signal services, medical services, engineer services, transportation services, and so forth. Those *are* the jobs of specialists.

Well, then, how do you work with your G4? First of all, pick a forceful man, determined and energetic, a man who has the qualifications of a commander. He has to be an alert, intelligent chap who stays on top of the game with all parts of your command, and it is even more important that he be on top of the game with the next higher headquarters. He must be a man with the qualifications of leadership and command.

Second, you work out with him regular periodic reports which will enable you to know how you stand logistically, both for the whole and in each subordinate command. These reports should be neither numerous nor complex for it is the job of your G4, exactly like the rest of your General Staff, to save your time by digesting into simple form the information you need.

Third, make it a practice to comment to your subordinate commanders (and of course to your staff) on the information you thus acquire. Your interest in any subject reverberates throughout your entire command.

Fourth, make command inspections.

Fifth, act aggressively with your superiors to insure that you get what you need in plenty of time. Here is an especially important point. Whenever the chief of a technical service from a higher level comes down to visit your headquarters, be loaded for bear. Show an aggressive and forceful interest in critical shortages. You will be amazed how delighted he will be by your knowledge, and how eagerly he will help you out. Neither your G4 nor your service chiefs can make the impression that is produced by your rank and prestige; that is just human nature.

I have thought a great deal for many years about the functions of the different General Staff sections. Each is different from the others. It may surprise you to know that G1 is the spot in which I prefer to train my future Chief of Staff. In the case of my G4, I consider him to be in fact—although not in title—the Deputy Commander for logistics. He does in fact command the seven technical services operationally. He is constantly making commitments at higher levels. You want him to act for you in the fullest possible manner, while you dominate the G3 field yourself.

In the Department of the Army, the command relationship of G4 is formally defined in regulations, which state that G4 "directs and controls the technical services." A G4 in the field exercises command informally, by force of personality and leadership, by intelligence and energy. While it is true

that his orders are always in the name of the commander, your G4 must be a man whose many day-to-day informal orders are not questioned by the recipients.

I consider it the personal business of the commander himself to spot individuals who are inadequate and must be replaced. He must handle such cases so as to protect his staff from being given the onus. The first thing you want from a staff is harmonious relations, within the staff itself, and with higher and lower commands. You want your G4 to maintain great harmony and trust throughout his extensive dealings. The best corps G4's I have known, in two wars at that level, steered away from recommending reliefs for incompetence. I do, of course, expect my G4 to answer honestly when I raise the question myself.

But I am sure that the detection and relief of inadequate subordinates is most peculiarly the job of the commander personally, and you must not neglect this in the technical services any more than elsewhere. The technical services (like everybody else) are always desperately short of good men. If you will put up with weak sisters, that is the only kind you will get, while other commanders get the good ones. Write that down in your book as the last fact of life.

I can summarize all this in few words. The ultimate business of a field commander is to destroy the enemy in combat. By personal foresight and care for his logistical arrangements, he can put them in order before the day of battle and thus free himself to turn his personal attention to the fighting.

But, in a broader sense, all of us still have a lot to learn about conducting oversea wars and supporting dependent allies. Scrutinize all recent historical examples with a most critical eye and you will find that our training of future commanders has not prepared them to cope with their logistic problems as skillfully as they cope with tactical problems; in fact, many of them have displayed ignorance and inadequacy which, if continued, can only result in an indefensible proportion of waste, extravagance and paralysis.

# INAUGURAL ADDRESS

PRESIDENT DWIGHT D. EISENHOWER

THE WORLD and we have passed the midway point of a century of continuing challenge. We sense with all our faculties that forces of good and evil are massed and armed and opposed as rarely before in history.

This fact defines the meaning of this day. We are summoned, by this honored and historic ceremony, to witness more than the act of one citizen swearing his oath of service, in the presence of his God. We are called as a people to give testimony, in the sight of the world, to our faith that the future shall belong to the free.

Since this century's beginning, a time of tempest has seemed to come upon the continents of the earth. Masses of Asia have wakened to strike off shackles of the past. Great nations of Europe have waged their bloodiest wars. Thrones have toppled and their vast empires have disappeared. New nations have been born.

For our own country, it has been a time of recurring trial. We have grown in power and in responsibility. We have passed through the anxieties of depression and of war to a summit unmatched in man's history. Seeking to secure peace in the world, we have had to fight through the forests of the Argonne, to the shores of Iwo Jima, and to the cold mountains of Korea.

In the swift rush of great events, we find ourselves groping

*Text of President Eisenhower's Inaugural Address, 20 January 1953, as published in the* CONGRESSIONAL RECORD.

to know the full sense and meaning of the times in which we live. In our quest of understanding, we beseech God's guidance. We summon all our knowledge of the past and we scan all signs of the future. We bring all our wit and will to meet the question: How far have we come in man's long pilgrimage from darkness toward light? Are we nearing the light—a day of freedom and of peace for all mankind? Or are the shadows of another night closing in upon us?

Great as are the preoccupations absorbing us at home, concerned as we are with matters that deeply affect our livelihood today and our vision of the future, each of these domestic problems is dwarfed by, and often even created by, this question that involves all human kind.

This trial comes at a moment when man's power to achieve good or to inflict evil surpasses the brightest hopes and the sharpest fears of all ages. We can turn rivers in their courses, level mountains to the plains. Ocean and land and sky are avenues for our colossal commerce. Disease diminishes and life lengthens.

Yet the promise of this life is imperilled by the very genius that has made it possible. Nations amass wealth. Labor sweats to create—and turns out devices to level not only mountains but also cities. Science seems ready to confer upon us, as its final gift, the power to erase human life from the earth.

At such a time in history, we who are free, must proclaim anew our faith.

This faith is the abiding creed of our fathers. It is our faith in the deathless dignity of man, governed by eternal moral and natural laws.

This faith defines our full view of life. It establishes, beyond debate, those gifts of the Creator that are man's inalienable rights, and that make all men equal in His sight.

In the light of this equality we know that the virtues most cherished by free people—love of truth, pride of work, devotion to country—all are treasures equally precious in the lives of the most humble and of the most exalted. The men who mine coal and fire furnaces and balance ledgers and turn lathes and pick cotton and heal the sick and plant corn—all serve as proudly, and as profitably, for America as the statesmen who draft treaties or the legislators who enact laws.

This faith rules our whole way of life. It decrees that we, the people, elect leaders not to rule but to serve. It asserts that we have the right to choice of our own work and to the reward

of our own toil. It inspires the initiative that makes our productivity the wonder of the world. And it warns that any man who seeks to deny equality in all his brothers betrays the spirit of the free and invites the mockery of the tyrant.

It is because we, all of us, hold to these principles that the political changes accomplished this day do not imply turbulence, upheaval or disorder. Rather this change expresses a purpose of strengthening our dedication and devotion to the precepts of our founding documents, a conscious renewal of faith in our country and in the watchfulness of a Divine Providence.

The enemies of this faith know no god but force, no devotion but its use. They tutor men in treason. They feed upon the hunger of others. Whatever defies them, they torture, especially the truth.

Here, then, is joined no pallid argument between slightly differing philosophies. This conflict strikes directly at the faith of our fathers and the lives of our sons. No principle or treasure that we hold, from the spiritual knowledge of our free schools and churches to the creative magic of free labor and capital, nothing lies safely beyond the reach of the struggle.

Freedom is pitted against slavery; light against dark.

The faith we hold belongs not to us alone but to the free of all the world. This common bond binds the grower of rice in Burma and the planter of wheat in Iowa, the shepherd in southern Italy and the mountaineer in the Andes. It confers a common dignity upon the French soldier who dies in Indochina, the British soldier killed in Malaya, the American life given in Korea.

We know, beyond this, that we are linked to all free peoples not merely by a noble idea but by a simple need. No free people can for long cling to any privilege or enjoy any safety in economic solitude. For all our own material might, even we need markets in the world for the surpluses of our farms and of our factories. Equally, we need for these same farms and factories vital materials and products of distant lands. This basic law of interdependence, so manifest in the commerce of peace, applies with thousandfold intensity in the event of war.

So are we persuaded by necessity and by belief that the strength of all free peoples lies in unity, their danger in discord.

To produce this unity, to meet the challenge of our time, destiny has laid upon our country the responsibility of the free world's leadership. So it is proper that we assure our friends once again that, in the discharge of this responsibility,

we Americans know and observe the difference between world leadership and imperialism; between firmness and truculence; between a thoughtfully calculated goal and spasmodic reaction to the stimulus of emergencies.

We wish our friends the world over to know this above all: We face the threat—not with dread and confusion but with confidence and conviction.

We feel this moral strength because we know that we are not helpless prisoners of history. We are free men. We shall remain free, never to be proven guilty of the one capital offense against freedom—a lack of staunch faith.

In pleading our just cause before the bar of history and in pressing our labor for world peace, we shall be guided by certain fixed principles.

These principles are:

(1) Abhorring war as a chosen way to balk the purposes of those who threaten us, we hold it to be the first task of statesmanship to develop the strength that will deter the forces of aggression and promote the conditions of peace. For, as it must be the supreme purpose of all free men, so it must be the dedication of their leaders, to save humanity from preying upon itself.

In the light of this principle, we stand ready to engage with any and all others in joint effort to remove the causes of mutual fear and distrust among nations, and so to make possible drastic reduction of armaments. The sole requisites for undertaking such effort are that—in their purpose—they be aimed logically and honestly toward securing peace for all; and that, in their result, they provide methods by which every participating nation will prove good faith in carrying out its pledge.

(2) Realizing that common sense and common decency alike dictate the futility of appeasement, we shall never try to placate an aggressor by the false and wicked bargain of trading honor for security. For in the final choice a soldier's pack is not so heavy a burden as a prisoner's chains.

(3) Knowing that only a United States that is strong and immensely productive can help defend freedom in our world, we view our Nation's strength and security as a trust upon which rests the hope of free men everywhere. It is the firm duty of each of our free citizens and of every free citizen everywhere to place the cause of his country before the comfort of himself.

(4) Honoring the identity and heritage of each nation of the world, we shall never use our strength to try to impress

upon another people our own cherished political and economic institutions.

(5) Assessing realistically the needs and capacities of proven friends of freedom, we shall strive to help them to achieve their own security and well-being. Likewise, we shall count upon them to assume, within the limits of their resources, their full and just burdens in the common defense of freedom.

(6) Recognizing economic health as an indispensable basis of military strength and the free world's peace, we shall strive to foster everywhere, and to practice ourselves, policies that encourage productivity and profitable trade. For the impoverishment of any single people in the world means danger to the well-being of all other peoples.

(7) Appreciating that economic need, military security and political wisdom combine to suggest regional groupings of free peoples, we hope, within the framework of the United Nations, to help strengthen such special bonds the world over. The nature of these ties must vary with the different problems of different areas.

In the Western Hemisphere, we join with all our neighbors in the work of perfecting a community of fraternal trust and common purpose.

In Europe, we ask that enlightened and inspired leaders of the Western nations strive with renewed vigor to make the unity of their peoples a reality. Only as free Europe unitedly marshals its strength can it effectively safeguard, even with our help, its spiritual and cultural heritages.

(8) Conceiving the defense of freedom, like freedom itself, to be one and indivisible, we hold all continents and peoples in equal regard and honor. We reject any insinuation that one race or another, one people or another, is in any sense inferior or expendable.

(9) Respecting the United Nations as the living sign of all peoples' hope for peace, we shall strive to make it not merely an eloquent symbol but an effective force. And in our quest of honorable peace, we shall neither compromise, nor tire, nor ever cease.

By these rules of conduct, we hope to be known to all peoples.

By their observance, an earth of peace may become not a vision but a fact.

This hope—this supreme aspiration—must rule the way we live.

We must be ready to dare all for our country. For history

does not long intrust the care of freedom to the weak or the timid. We must acquire proficiency in defense and display stamina in purpose.

We must be willing, individually, and as a nation, to accept whatever sacrifices may be required of us. A people that values its privileges above its principles soon loses both.

These basic precepts are not lofty abstractions, far removed from matters of daily living. They are laws of spiritual strength that generate and define our material strength. Patriotism means equipped forces and a prepared citizenry. Moral stamina means more energy and more productivity, on the farm and in the factory. Love of liberty means the guarding of every resource that makes freedom possible—from the sanctity of our families and the wealth of our soil to the genius of our scientists.

So each citizen plays an indispensable role. The productivity of our heads, our hands, and our hearts is the source of all the strength we can command, for both the enrichment of our lives and the winning of peace.

No person, no home, no community can be beyond the reach of this call. We are summoned to act in wisdom and in conscience; to work with industry, to teach with persuasion, to preach with conviction, to weigh our every deed with care and with compassion. For this truth must be clear before us: Whatever America hopes to bring to pass in the world must first come to pass in the heart of America.

The peace we seek, then, is nothing less than the practice and the fulfillment of our whole faith, among ourselves and in our dealings with others. It signifies more than stilling the guns, easing the sorrow, of war.

More than an escape from death, it is a way of life.

More than a haven for the weary, it is a hope for the brave.

This is the hope that beckons us onward in this century of trial. This is the work that awaits us all, to be done with bravery, with charity, and with prayer to Almighty God.

# QUALITIES AND TECHNIQUES OF LEADERSHIP

General J. Lawton Collins

WHAT are the qualities which make a good leader? There are not many. I would list, first of all, character and integrity, and then, of course, courage—not merely physical courage but moral courage. Next I would list good health, which we often take for granted. And the last quality, perhaps the most important, is the matter of having a human touch about you. You have to learn how to get close to your men and how to lead them.

These are all God-given qualities, by and large, and they are rather hard to develop unless they are in your heart and soul; but fortunately, there are certain techniques of leadership which can be learned by experience.

The first of them is that you must know your business and must set a high standard of performance for the men you command. See for yourselves what is going on in your units. Do not take anybody's word for it. In action, the man who depends upon someone else to find out what is going on will never be a proper leader for American men. So see for yourselves.

The next point is that you must constantly explain to the men who are under you what it is you are driving at if you expect to get full obedience and co-operation from these men. There will, of course, come times when you must order something to be done and when there is no time to explain the reason why. Such instances demand immediate obedience. But you will not get the type of obedience I am talking about unless during training you have explained constantly what were the objectives you were seeking. It has been my experience that if you only take the American soldier into your confidence and tell him what you are driving at, he will meet you more than half way every time.

Another of these techniques of leadership is that you must learn to place responsibility on your subordinates. You must decentralize and not try to do everything yourself. It just cannot be done. You have to put responsibility on the non-commissioned officers who will be under you and, as you proceed in rank and experience, on the young officers who will be under you. Give them a chance and give them responsibility.

Finally, you must look after the interests of your men—first, last and all the time. You have not only a priceless privilege but also a great responsibility in leading the young men entrusted to your care.

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*From General Collins' commencement address at The Citadel, Charleston, South Carolina, June 1952.*

*The comparison microscope is used to determine whether two bullets have been fired from the same weapon.* U. S. Army Photograph

# CRIME LABORATORY ON WHEELS

COLONEL JEREMIAH P. HOLLAND

EVERY DAY is "Quiz Day" at the Criminal Investigation Laboratory of The Provost Marshal General Center, Camp Gordon, Georgia. By air shipment and courier, a varied array of objects arrives for study and analysis—a blood stained garment, a battered bullet, a bit of clay from a suspect's shoe, a fragment of skin taken from beneath a murder victim's fingernails, a burglar's jimmy and a piece of wood with matching indentations, or a document suspected of being forged.

Is the blood on the garment animal or human, and, if human, what type is it? Could the bullet have been fired from a certain gun? Does the clay come from a specific locality?

Often these questions are fraught with life and death significance. The Laboratory staff keenly realizes that it is just as important to prove that a suspect is innocent as it is to pin the guilt on the actual criminal. They therefore must be painstakingly accurate and precise in their analysis. Take the case of the two human hairs which, under close microscopic study, enabled the Army's criminal investigators to describe an unknown murderer as ". . . a man of middle age, of robust constitution, inclined to obesity, black hair intermingled with gray hair, recently cut, commencing to grow bald"—a description, incidentally, which led to his arrest.

Keeping pace with the trend toward increased mobility in warfare, the Center has launched as its newest project a traveling miniature of its Criminal Investigation Laboratory. This laboratory is the only military one of its kind in the United States, although a prototype exists in the European Command.

Housed in an olive-green 35-foot trailer truck, the rolling workshop is equipped to carry on the technical analysis normally available at the base Laboratory—with the added advantage that it can furnish on-the-spot reports in the field.

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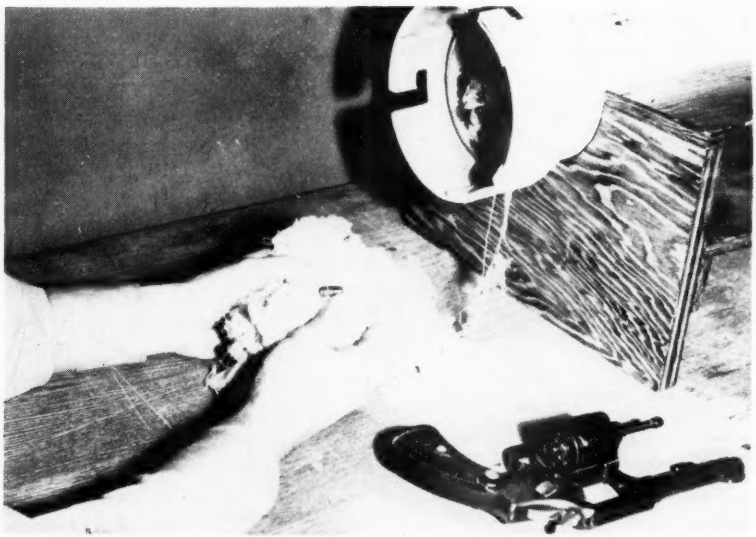
*COLONEL JEREMIAH P. HOLLAND, Military Police Corps, is Commanding Officer, The Provost Marshal General Center, Camp Gordon, Georgia.*

The benefits of a mobile laboratory were demonstrated in World War II when Major (then Captain) George R. Bird devised such a unit to follow in the wake of our forces advancing across Europe. Its accessibility in forward areas helped solve a great many crimes which might otherwise have eluded detection because of the rapid turnover of troops near the scene of a crime. It was especially valuable in overcoming the time lag involved in transporting evidence long distances over uncertain transportation facilities in the war zone. Today's mobile crime laboratory is an outgrowth of that World War II experience.



*A firearms expert removes a bullet from the recovery tube prior to making a microscopic comparison.* U. S. Army Photograph

Compactly arranged within the unit are facilities for administering the detachment, including file cases, radio and telephone equipment. The darkroom contains all necessary supplies for developing, enlarging and printing photographs, utilizing black-and-white, infra-red and ultra-violet techniques. The chemical analysis laboratory is outfitted with microscopes, an oven, and a refrigerator for preserving blood serums and biological specimens. The document, fingerprint and firearms identification sections are equipped with comparison microscope, bullet recovery tube and photo-micrographic camera.

The Field Laboratory is self-contained, able to function independently of regular utilities and installations normally found

in rear echelons of the combat zone. It houses an air-conditioning unit, gasoline burning generator, hot water heater and electric water pump. Fluorescent lamps provide proper lighting, and air conditioning maintains the constant temperature required for photographic work and chemical analysis.

Like its parent organization, the Field Laboratory performs chemical and microscopic tests on matter ranging from blood, alcohol and narcotics to hair, fiber, paint and body fluids. It also has facilities for fingerprinting persons who cannot otherwise be identified. Under combat conditions, it would carry a polygraph or "lie detector" to render immediate assistance in gauging the guilt or innocence of suspected persons, bringing into play the latest psychological principles of interrogation.

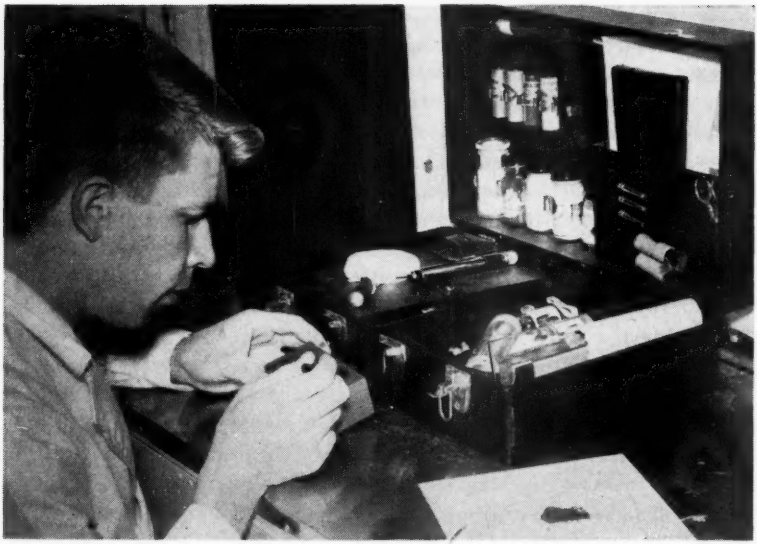
To develop skill in field operations, the mobile unit takes part in joint service maneuvers and demonstration tours. Operating personnel are drawn on rotation from among technicians at the Criminal Investigation Laboratory.

Traveling some 4500 miles through the First and Second Army Areas, the Field Laboratory visited eighteen military installations. Representatives from Federal, state and municipal investigative agencies attended the demonstrations where both military and civilian police authorities were oriented on the latest techniques used by the Military Police Corps.

A typical need for the unit's services occurred at Fort Dix, New Jersey. A soldier was found in possession of a pistol which appeared to be Government property but which carried a serial number seemingly indicating private ownership. The pistol was turned over to the Laboratory for study. An etching solution was applied to the serial numbered area and an obliterated number was revealed. The results were then photographed and forwarded to Military Police investigators for further action.

In the spring of 1952, the field unit participated in Exercise Long Horn, the combined Army and Air Force tactical training operation in the use of chemical and atomic weapons at Fort Hood, Texas. While there, the case of a mentally disturbed soldier who fatally shot a young lieutenant was the subject of investigation. The evidence was processed by the Field Laboratory operating in the immediate area.

The exercise marked the third time in as many years that the Laboratory participated in tactical operations. Previously the unit had seen service in Exercise Southern Pine in 1951 and in Exercise Swarmer in 1950. During these maneuvers, it helped expedite analysis of evidence which might otherwise have had



*A specialist develops a latent or invisible fingerprint pattern taken at the scene of a crime.* U. S. Army Photograph

to be shipped to Camp Gordon for investigation. The Field Laboratory was declared neutral during the exercises so facilities could be available to both friendly and Aggressor forces.

The crime laboratory caravan also toured service camps and schools in the South. Orientation demonstrations were given at the University of Texas for the ROTC units there, and at Fort Sill, Oklahoma, Camp Chaffee, Arkansas, and Camp Polk, Louisiana. While intended primarily for military personnel, the lectures and demonstrations attracted a sizable attendance of state and local civilian police authorities.

Still undergoing refinement, the mobile unit is being tested constantly to determine what additional improvements in procedures, equipment and vehicular design are needed to give the men of the Army's Criminal Investigation detachments the best possible support. Continuous efforts are expected to contribute materially to the attainment of the Military Police goal —the preservation and safeguarding of justice throughout the military establishment.

# VEHICLE FOR LAND AND SEA

LIEUTENANT COLONEL GEORGE L. WILLEY

WHEN THE stiffly professional generals of Hitler's high command sat down to plan the defenses of Fortress Europa, they concluded that without the major ports along the French and Belgian coasts, Allied armies could never keep their foothold. All precedents indicated that hundreds of freighters would be needed to supply an invasion force and these vessels needed proper docking facilities to discharge their cargoes.

One thing, however, upset these calculations and helped spell defeat for Hitler—the Allied capacity for improvising port facilities where none existed. A typically American military vehicle, the 2½-ton, 6x6 amphibian truck (DUKW) carried millions of tons of supplies ashore where there were no harbors or docks. During the first four months after D-Day the Allies unloaded thousands of tons of materiel across the beaches, about half of it in DUKWs. Waddling into the surf, they paddled alongside the cargo ships, swam back to shore, and then delivered their loads a dozen miles up the nearest road.

Today the Transportation Corps is pushing the development of bigger and more efficient amphibious cargo vehicles. In November 1952 it unveiled a big brother to the DUKW, a hulking monster called the BARC (Barge, amphibious, resupply, cargo). At Fort Lawton, Washington, the BARC put on an impressive demonstration before government and military observers, during which it showed its capabilities afloat and ashore in tasks far outranging present amphibious vehicles. It emerged from the water carrying a 35-ton medium tank and a 35-ton crane, rolled up on the sand, lowered its bow ramp, and the tank in full combat readiness rumbled out under its own power followed immediately by the crane. Next, the BARC demonstrated its agility on land by maneuvering over log obstacles, executing turns and climbing a 45-degree slope.

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*LIEUTENANT COLONEL GEORGE L. WILLEY, Transportation Corps, is Technical Liaison Officer, Office of the Chief of Transportation, Department of the Army.*

*The amphibian truck (right) of World War II is dwarfed by the BARC newly developed by the Transportation Corps.* U. S. Army Photograph

*Heavy items of equipment can be brought ashore in the BARC. Here a tank emerges from the experimental vehicle.* U. S. Army Photograph

Even in an age of mammoth vehicles, the BARC is an impressive piece of machinery. It is 61 feet long, 27½ feet wide and 16 feet high. It has a cargo space of 36x14 feet and can carry a 60-ton pay load or 100 tons in an emergency. A single one of its four wheels dwarfs the average man. Its tires, size 36.00x41, are nearly ten feet high, the largest produced.

To move this monster over land takes not one engine but four. Each giant wheel is powered by an individual 165-horsepower Diesel which transmits power through a torque converter. A separate transmission for each wheel gives the vehicle three forward speeds and one in reverse. Shifting the four engines from one gear to another is done simultaneously for the driver by synchronized air controls. The wheels incorporate a feature which most motorists would like to have on their cars—a hub inflation system which permits the driver to adjust tire pressure at any time. When operating over soft sand and coral, for example, the tires can be partly deflated to protect them and give added traction. Later, the tires can be inflated without a time-wasting stop.

In spite of its size, the BARC can turn about in a 75-foot radius. The steering mechanism consists of two 30-ton hydraulic rams and the vehicle can be steered in three different ways. First, in "normal" steering, the rear wheels are locked in a straight forward-to-rear position and only the front wheels can be turned. Second, in "full" steering, both front and rear wheels turn in opposite directions for sharp maneuvering. Finally, in "crab" steering, both front and rear wheels can be pointed in the same direction for a kind of side-slipping movement.

Essentially, however, the BARC was designed to do its biggest job in the water as a self-propelled barge. Twin propellers drive it through the water. Each screw is powered by two of the four engines which supply power to the wheels, while a fluid coupling eliminates the need to synchronize the engines. Bilge pumps capable of discharging four thousand gallons of water per minute keep the cargo hold dry in rough weather.

The BARC's design greatly facilitates cargo unloading on beaches, always a bottle-neck during crowded invasion landings. Smaller vehicles can be unloaded in a matter of minutes by way of the hydraulically operated bow ramp. In addition, there is a stern winch with a 25-ton pulling capacity to help budge heavy pieces of cargo. Floodlights in the hold permit stevedoring operations during darkness. To offset fire hazards a carbon dioxide extinguishing system will flood the hold at the touch

*Tires for the BARC are the largest commercially produced. Each measures nearly ten feet in diameter.* U. S. Army Photograph

of controls either in the driver's cab or from outside the vehicle.

Surprisingly, no large crew is required to operate such a complex vehicle. The BARC has a basic crew of only three men—a driver, an assistant driver who doubles as a radio operator, and a mechanic to perform regular maintenance tasks and make emergency repairs. Compressed air does all the heavy work normally required to operate such a ponderous vehicle. With seven thousand feet of tubing feeding compressed air to the various control mechanisms, the driver handles the BARC almost as easily as driving a truck, while he and his assistants sit in a glass enclosed cab high on the port bow.

The BARC—one of four on order—is an experimental vehicle which specialists of the Transportation Research and Development Station at Fort Eustis, Virginia, plan to use as a giant guinea pig in tests and design studies. Eventually a standard model much more simplified in construction, operation and maintenance will result. For the present, the BARC's size and weight must be limited to what its tires—the largest commercially produced—can handle. But with larger tires capable of supporting more weight, the BARC can be made larger.

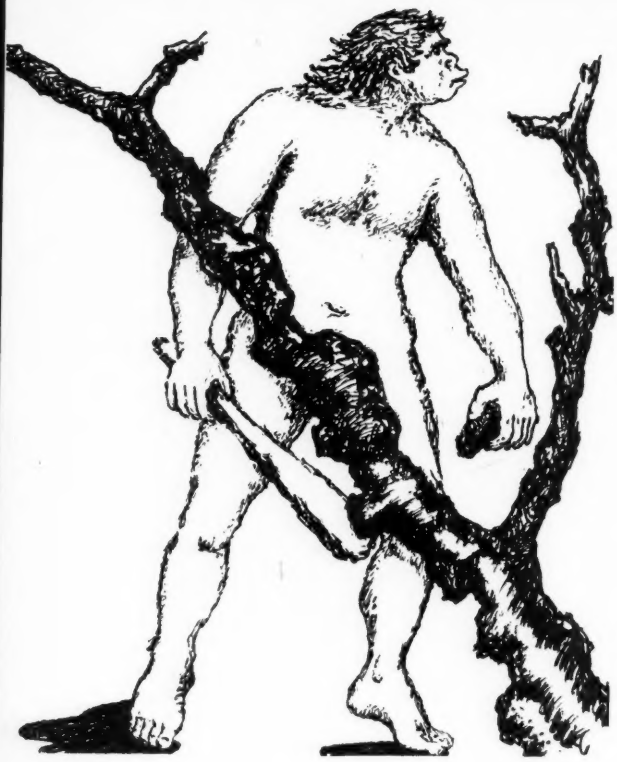
Its size already poses one problem—that of transporting it to distant parts of the globe where it would be used in initial landing operations on giant construction projects. Obviously it

is not a long distance road vehicle and it would not ride comfortably on the average railroad flat car. The answer is water shipment, or, under certain conditions and within reasonable distances, self-ferrying.

The Transportation Corps sees in the BARC a possible answer to certain difficulties encountered in landing operations during World War II, particularly the problem of congestion on the beach-heads. Too often invasion operations saw landing craft, cranes and trucks getting in one another's way while trying to keep the flow of supplies moving inland. With its capability of moving on land at speeds of ten miles an hour with heavy loads or fifteen miles an hour empty, the BARC could greatly relieve this tie-up along the beach.

Still another problem was the threat of rampaging storms which could swamp or wreck an entire fleet of landing craft. When storms descended during World War II, landing craft had to suspend operations and take shelter wherever it could be found. This sometimes meant days of delay while the craft scurried miles out of the storm's path and back again to resume operations. The BARC can meet such dangers by simply driving up on dry land and waiting until the heavy waves subside. It can even perform such a maneuver in hiding from enemy bombers or submarines.

Built to overcome the DUKW's limited pay load and inability to handle bulky equipment, the new BARC may some day upset the calculations of another enemy high command.



# FROM CLUBS AND SPEARS

LIEUTENANT COLONEL

## I—Early Tools of War

THE CLUB was so universally employed by primitive man that, although originally intended as a tool for providing food and collecting wives, it can be considered the ancestor of all weapons of war. It has been a companion arm of man, in one form or another, since the beginning of time. Today, as a reminder of its once devastating force, it is used as a symbol representing the highest authority, *i.e.*, the field marshal's baton and the emperor's scepter—a tribute to the man who best wields the club.

Still another primitive method of attack—throwing rocks—marked the employment of missiles for the first time as a weapon. Throughout the centuries countless man hours and sums of money have been expended to break away from this

*LIEUTENANT COLONEL GEORGE M. CHINN, USMC, Navy Bureau of Ordnance, is the author of* "The Machine Gun." *This is the first in a series of three articles extracted from that publication. The opinions expressed are those of the author and do not necessarily represent official views of the Department of Defense or any of its agencies.*

# TO AUTOMATIC WEAPONS

COLONEL GEORGE M. CHINN

mode of lethal delivery. However, the result has been only a refinement—evolutionary, but in no sense revolutionary.

Even the club did not remain unchanged. Man, in his unholy desire to conquer, made early refinements. In the stone age, a rock with a sharp edge was fastened to his club to form an ax. When iron or copper was first smelted, a metal spear blade added much to the cutting and puncturing ability of the club. It soon evolved into a versatile instrument that could kill a man by three methods—cutting, concussion or perforation. These techniques have remained basic throughout the years. The double-edged battle-ax with a pike on the blade end and a spiked ball secured by a short chain to the rear of the handle represents the last word in the development of the club from a single-purpose, bone-crushing affair to a tri-method instrument.

When the possibilities of metal-working were realized, knives and daggers appeared in thousands of shapes—short and long, blunt and sharp, heavy cleavers and long slim rapier blades. The origin of our present metallurgy begins with man's efforts to temper the cutting edge of his weapons. Nothing was left undone in his constant experimentation—including quenching the red-hot blade in a living human body, in the belief that the

blood gave the blade a superior cutting power.

Each of the many designs was for a specific purpose. The dagger originated as a weapon to be inserted through the vulnerable joints and openings in armor. The broad sword was short, wide, and sharp on both edges, and was used like a cleaver to split an enemy down the middle. Later swords were again narrowed and straightened for use in thrusting, to take the place of the powerful slicing stroke.

The Far East contributed the scimitar with its crescent shaped blade sharpened on one side only. The curve added much to the slicing power. And in due time its influence reached Europe to be incorporated in the cavalry saber with its long single-edged blade slightly curved.

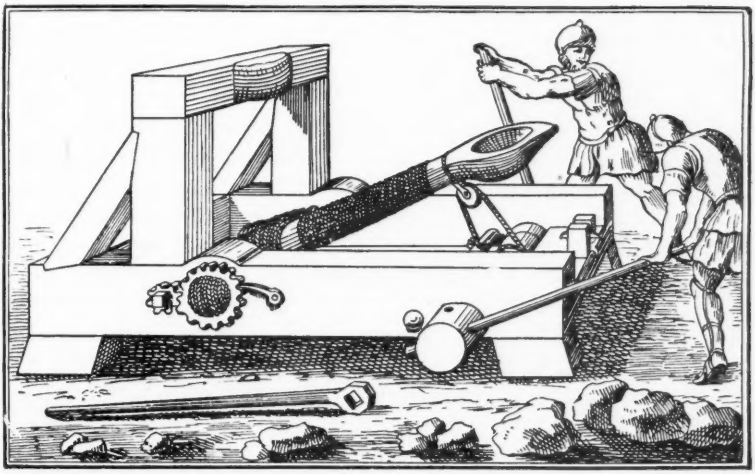
Projectile-throwing devices were developed also and used in conjunction with the club and knife. From the first rock throwing and rolling came the sling, bow and catapult.

The bow is one of the projectile throwers devised by man; still another was the sling. The Phoenicians were credited by ancient writers with invention of the sling. The inhabitants of the Balearic Isles used leaden projectiles with a reputed range of over six hundred yards. Ancient Egyptian and Assyrian soldiers also used slings. The Bible credits to the tribe of Benjamin phenomenal accuracy with this weapon: "Among all this people there were seven hundred chosen men left-handed; every one could sling a stone at an hair and not miss."

The Roman Legions called the slingman the *funditor,* and considered him an integral part of the army. But human muscle had its limit and the sling's last major military appearance was during the Huguenot Wars.

Among the hand projectile-launchers, however, the bow served man more efficiently than anything of a similar nature. The constant search to better his existing weapons led the prehistoric warrior to experiment with the construction of bows. The horns of animals were steamed and cut into strips. They were then dried, glued and scraped into the desired shape. In addition to laminated horn, combinations of woods and the ribs of animals were used. They were wrapped with strips of inner tree bark or animal gut, in the belief that greater throwing power was given.

The idea of a more powerful weapon to out-range the bow and sling received serious constructive study in the East during the ninth and eighth centuries B.C. According to the Bible, Uzziah, who reigned from 808 to 756 B.C., "made in Jerusalem



*Twisted ropes furnished the propelling force for this siege catapult of medieval days. When the winch was released, the throwing beam struck against the brake timber, hurling a rock from the cup for a distance of several hundred yards.*

engines invented by cunning men, to be in the towers and upon the bulwarks, to shoot arrows and great stones withal." Ezekiel records that Nebuchadnezzar in besieging Tyre in the sixth century B.C. set engines of war against the walls.

The Greeks were slower to adopt such improvements. Diodorus records an expedition of Dionysius, tyrant of Syracuse, against the Carthaginians in 397 B.C. "The Syracusians . . . killed great numbers of the enemy by their sharp arrows, shot out of their engines of battery." From Syracuse the war engine was introduced into Greece.

Dionysius also attempted to improve upon the single bow by inventing a weapon called the *polybolus,* or repeater thrower, which projected a succession of arrows supplied from a kind of magazine. This is the first recorded example of a mechanical means of sustained fire, giving the soldier who operated it the fire power of several men. There was an interval of thirteen centuries before another advance in fire power warrants mention. At the Battle of Hastings a few archers were equipped with a mechanical bow arrangement designed to discharge several arrows at a time.

"Engines of War" mentioned by Biblical and classical writers usually were variations of the catapult and the ballista. The first was for high, and the second for low, angle fire. In either

case the propelling force was transmitted by tightly twisted skeins of hemp, hair or sinews. (Replicas of these instruments have been made but the method of maintaining the elasticity of the sinew remains unsolved.)

The origin of the catapult seems to have been a bent-over, forked sapling for hurling rocks. However, this idea was improved until it became a bulwark in offensive and defensive warfare. Later, heavy wooden framework carried strong rope strands across the base. Into these twisted ropes went the tossing beam, with a cuplike holder at the top. Winches pulled back the thrower, twisting the rope so that a great force was stored as in an elastic cord or spring. When released, the throwing beam whirled up and forward, struck against the brake timber, and tossed its rock from the cup a few hundred yards. Catapults were not very accurate, but a battery of them could pound a wall or fort to dust in a few days.

On the scorpion type catapult a sling was added to increase its range. The maximum distance for a round stone weighing one talent (approximately fifty-eight pounds) was recorded at four hundred yards. Ranges varied up to eight hundred yards depending on the weight of the missile used. The projectiles were not always stones that had been rounded. Sometimes they were pebbles molded with clay into balls and baked to a pottery finish. These shattered upon impact, throwing fragments which the enemy could not reuse in his own machines.

The trebuchet was a medieval contribution to the rock-throwing devices. It got its power not from a taut cord or twisted rope but from a heavy counterweight. The throwing beam was swiveled on a strong axle near the top of the framework. The bottom carried heavy weights and the top a throwing cup. Winches pulled back the top so that the bottom weight moved up and forward. Upon release, the weighted beam swung down like a huge pendulum. The top struck the brake beam, and the rock was hurled at the enemy's fortifications.

The ballista usually consisted of a sturdy framework which held a horizontal bow of strong laminated wood. From its ends extended a heavy cord of hemp or gut which was pulled back by winches until a heavy tension was obtained. The gut string worked in a grooved frame into which a javelin ten or twelve feet long was placed. When the release allowed the arms to snap forward, the javelin was driven four hundred and fifty to five hundred yards with a tremendous force and unusual accuracy for this type of weapon.

Another form of ballista used twisted rope made from hair and sinew for elasticity. Even small engines of this type with two-foot arms and four-inch ropes could throw a one-pound round stone three hundred to three hundred and fifty yards.

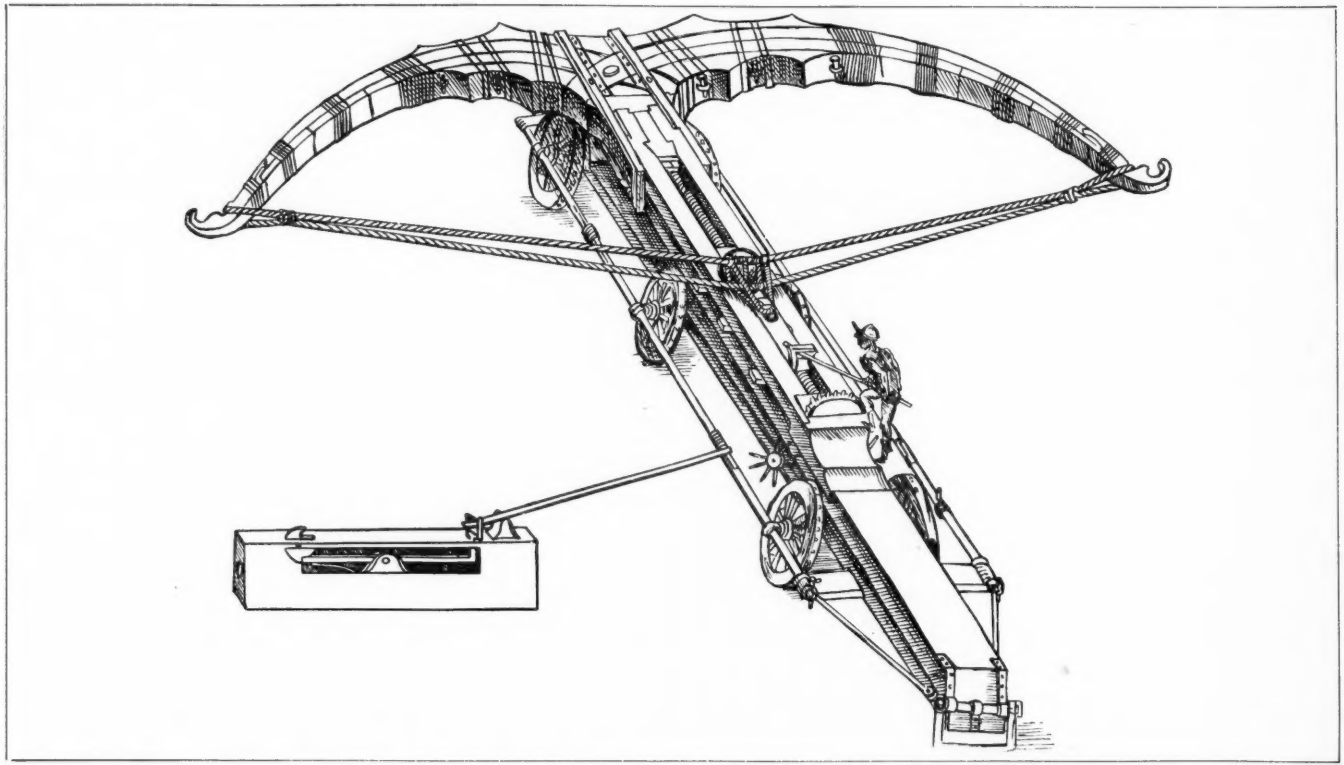
An improved arrangement of the ballista had an upright frame carrying two pairs of vertical ropes which, when twisted, furnished the necessary energy. A wooden piece was thrust between each pair of ropes forming the two arms of the bow. These were connected at their other ends by a bowstring. A slotted stock in the frame served as a guide along which the bowstring propelled the missile (either bolt or ball). Tension was applied by a winch.

One type of ballista employed an oversized bow laid horizontally and cocked mechanically. This heavy device was much older than the individual soldier's crossbow which it so closely resembled. The latter was an eleventh century adaptation of the larger weapon, combining the basic working principles of the bow and catapult and reducing the size and weight until it could be operated by a single soldier.

Norman artisans are credited with invention of the crossbow. Its use was general throughout the armies of Europe after its introduction, but it was by no means looked upon with favor by all the rulers of the time. Pope Innocent II in 1139, after the Second Lateran Council, called it "a most barbarous and cruel weapon" and forbade its use among warring Christian nations under penalty of anathema as "a weapon hateful to God and unfit for Christians."

The hiring of foreign crossbowmen was also prohibited by the Magna Carta. However, against the infidels, the crossbow had the blessing of the Church. As a weapon it was much admired by Richard Coeur de Lion. On his crusade against the unbelievers he took a thousand crossbowmen with him. After he popularized it, the crossbow came into general use in all European armies in spite of anathema. Richard's death from a quarrel shot from a crossbow was considered a judgment from heaven, for he had championed a weapon that could "proletarianize war."

England was also the first country to realize the military shortcomings of the crossbow. A simpler and more powerful weapon, the English longbow, which gained prevalence in the fourteenth century, is considered the highest degree of refinement of the bow. It was used effectively, and with fair accuracy, at ranges of six hundred to eight hundred yards. The phenomenal



*The versatile Leonardo da Vinci (1445-1520) drew up plans for a siege ballista in the form of an immense crossbow.*

success of the English archer was no matter of chance but the result of deliberate planning.

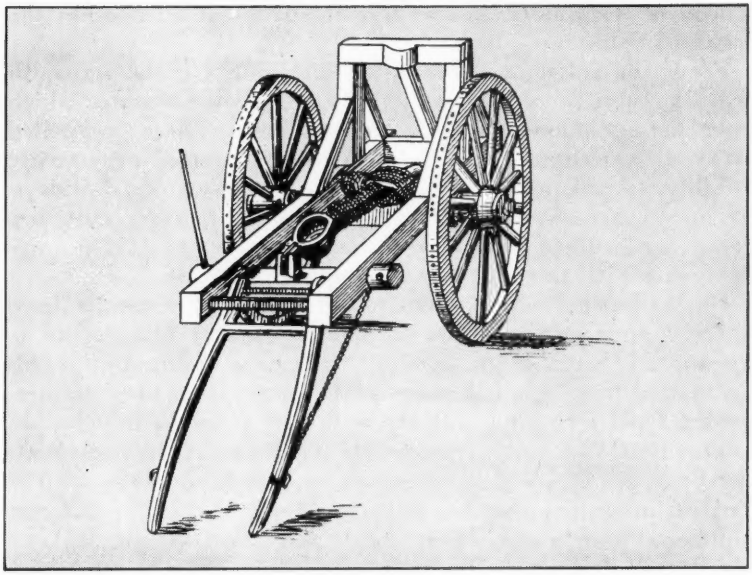
From the reign of Edward I (1271-1307) to the sixteenth century, there were placed in the English code statutes which later became known as the Archery Laws. These compelled every male citizen from twelve to sixty years of age, except nobility, to practice with a longbow on Sundays and holidays. Archery ranges were erected in every town at community expense; and village officials were charged with providing equipment and with the planning of community meets.

During this period the design of the longbow was standardized. Specifications stated that it be of elm, six feet four inches in length, and capable of driving "an arrow a hundred yards through a four-inch oak door until the arrow and shaft protruded from the other side the width of a hand's breadth."

The Battle of Crecy, fought on 26 August 1346, represents the peak efficiency of the longbow as a military weapon. The English army, commanded by Edward III (1327-77), was outnumbered four to one. Yet it routed and practically annihilated the powerful army of Philip VI of Valois. The perfect marksmanship of the English longbowmen maintained throughout the battle a superiority of fire of ten arrows against one from the crossbows of Philip's Genoese. It was common for the expert English archers to have three arrows in the air at one time from the same bow. Not only did they have a higher rate of fire, but they greatly outranged Philip's soldiers. The English arrows easily pierced the light armor of the French horsemen, upon whose charges Philip had relied to bring him ultimate victory. Although the cavalry made sixteen attempts to break the English lines, not one attack was even partially successful. The battle lasted only a few hours, but the English bowmen pumped volley after volley of arrows into the hapless French forces, until they were a struggling mass of wounded horse and foot soldiers trying to escape. Of the forty thousand men in King Philip's original army, over twenty thousand were casualties. The English losses were fifty.

With the overwhelming victory at Crecy, the English longbow was firmly established as the paramount military weapon of the day. The English army, as a result, enjoyed its greatest reputation throughout Europe. The French, in justifiable alarm, sought the services of Italian metalsmiths to design coats of mail capable of resisting the penetrating powers of the high-velocity longbow arrows.

*The versatile Leonardo da Vinci (1445-1520) drew up plans for a siege ballista in the form of an immense crossbow.*



*This small catapult on wheels was adapted for use as light field artillery.*

At the battle of Auray, in 1365, the French and English again met under conditions somewhat similar to Crecy. However, this time the French felt secure in their new armor. It took but a short time for the English to discover that their formerly lethal arrows were being deflected harmlessly to the ground. They also observed, in an equally short time, that while the French soldier had protected himself against the arrows, he had done so at the expense of mobility. Each individual was so loaded with his own armor that movement was difficult. The English promptly threw down their longbows, not in disgust, but because they sensed an easier solution to the work at hand. They advanced boldly on their stiffly encased foes and, seizing the Frenchmen's own axes and pikes, they beheaded and bludgeoned thousands, inflicting losses that were even greater in comparison than those at Crecy. Oddly enough, the reputation of the longbow was even more enhanced by this fact. For it was quickly realized throughout the military world that to protect oneself adequately against longbow arrows required wearing such cumbersome armor that the wearer would be exposed to almost certain death from other means.

Strange as it may seem, the Battle of Crecy, which showed

the longbow at its best, was also the scene of an incident that sounded the death knell, not only of the bow, but of all merely mechanical means of missile propulsion. This battle saw the first recorded use of artillery in an engagement between major armies and heralded explosives as a means of missile propulsion. However, the justified praise of the longbow was so great at this time that were it not for the meticulous writings of a few historians of the day, it would have gone unnoticed that Edward III employed stampede cannon on his flanks. These devices represented artillery in its crudest form and were mainly used, as the name implies, to scare the enemy's horses and strike terror into the untrained foot soldier. Missile throwing ability was secondary.

Earliest cannon design appears to have been that of an iron tube incased in wood to give it further support and still keep it light. The explosive was a crude black powder to which generally was added various kinds of wax, the mixture being made into balls. The balls, when discharged, produced an effect somewhat like an oversized Roman candle. The cannon's front end was supported by a metal fork and, to take care of recoil, the butt simply was placed against a convenient knoll. Firearm development stems from this modest beginning.

Just as human muscle had its limitation, so did the awkward and bulky mechanical missile throwers, which in turn gave way to a newer, more efficient means for waging war—namely, the chemically stored energy called gunpowder. That the Chinese knew of gunpowder centuries before, there is no doubt. Yet the actual date of the discovery is of little military significance compared to that of its first use as a fuel for the engines of war.

Both Roger Bacon and Barthold Schwartz, a German monk, are erroneously credited with the discovery of gunpowder. Their contribution was the preparation of explosive mixtures. Gunpowder, as such, did not exist till the mixtures were applied to the propelling of missiles.

Although Bacon suggests several military uses for his explosive (for instance, "an enemy might be either blown up bodily or put to flight by the terror caused by the explosion"), there was nothing to be found in any of his writings to show he ever once contemplated its use as a missile-throwing agent. The identity of the individual who first thought of propelling a projectile through a tube from the force generated by gunpowder still remains a mystery.

*Among the devices used to bend the crossbow were the cranequin and goat's-foot lever. At lower left a crossbowman employs the cranequin, a combination windlass and ratchet, while at lower right tension is applied by goat's-foot lever.*

The German monk, Barthold Schwartz of Cologne (1310-84), has often been credited with originating gunpowder. He undoubtedly invented a system for casting bronze cannon and established a workshop in Venice in 1377. He was ordered put to death by the Venetian Senate for insisting he be paid for his work on cannon design.

But other artisans and craftsmen were working on gunpowder as a propelling charge before Schwartz opened his shop. In 1339 mention is first made of a new type of firearm called the *ribauld* or *ribauldequin*. This was a primitive multibarrel affair consisting of several iron tubes, arranged to be fired simultaneously. Its purpose was to blast an opening in the solid rank of heavily armored pikemen who were supposed to keep the cavalry from the bowmen. In one of England's wars with France, Edward III used this weapon to good advantage in conjunction with his battle-tested stampede cannon. For, even at this early date, the theory of volume fire was being considered by the military thinkers of the time.

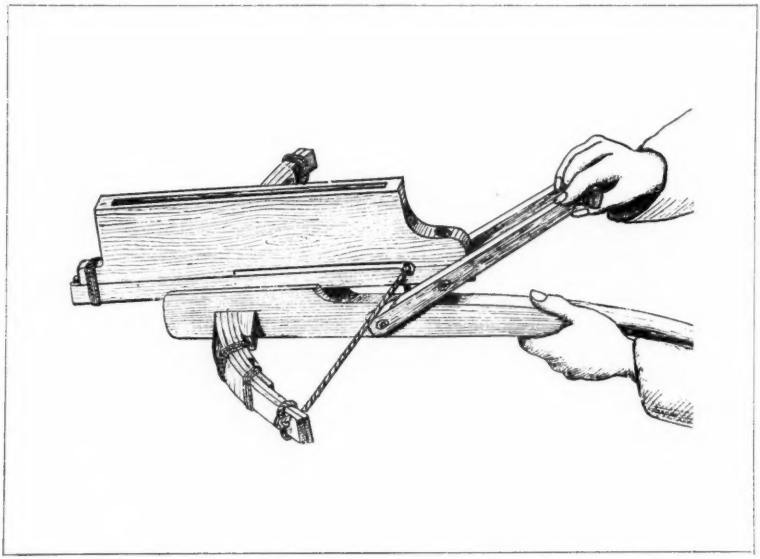
One of the most progressive types of firearms in the fourteenth century was a wrought iron single-shot breech-loading gun, the breech of which was wedged after being dropped into position. The principle was somewhat the same as the present-day system of locking. It is a curious fact that gunmakers should have developed so advanced a method of charging and then abandoned it in favor of the inferior muzzle loading.

Considering the crude work of the fourteenth century mechanic, the religious restrictions of the times, and the total ignorance of metallurgy in relation to powder pressure, the progress in firearms was comparatively rapid. In those days of muzzle-loading battery guns, the universal method of placing the barrels in stacks side by side in a frame led these assemblies to be called organ guns or *orgues des bombardes*.

In 1382 the army at Ghent had 200 *chars de cannon* in the field. These weapons consisted of a number of barrels fastened horizontally on two-wheeled carts with pikes and heavy sharp blades attached to the hubs as a further lethal garnishment. In 1411 the Burgundian army had two thousand of these weapons.

A more elaborate design having one hundred and forty-four barrels was constructed in 1387. These were grouped in batteries, allowing twelve salvos of twelve balls each to be fired against the enemy. Regardless of the clumsy mounting and great transportation difficulties of the organ gun, the demand for fire power, even then, led to their use in many theaters of operation.

Mohammed II (1451-81) in his conquest of Constantinople (1453) recognized the advantages of a new weapon—the bombard. Fabulous accounts state that the largest of his cannon threw 1200-pound stones having a diameter of thirty inches. The bombard needed between fifty and seventy oxen to transport it while four hundred men were required to attend it. The rate of fire was seven rounds a day, two hours being required for reloading. Some authorities credit as many as thirteen of these monstrosities to Mohammed II's artillery, which included fourteen batteries and fifty-odd cannon of assorted sizes and shapes. But, whatever the statistics, it is claimed that this was the first use of cannon as the principal weapon in an engagement between major armies.



*This early model repeating crossbow fired arrows which were fed singly from a holder built into the weapon.*

Louis XII (1498-1515) is said to have employed a gun having fifty barrels, so arranged that all could be fired in one volley.

As a whole, early multifiring weapons could be termed only a moderate success. They were extremely heavy and clumsy to handle. While all the barrels could either be fired at once or in rapid succession, the advantage of momentary volume of fire thus attained was soon cancelled out by the long periods of inaction caused by the need to muzzle load each individual

barrel. This inability to deliver sustained fire restricted its use to supporting or auxiliary employment. But at a critical point in battle, one could be maneuvered into a position where a concentrated blast would have a serious effect. In order that all barrels be fired simultaneously, or as nearly so as possible, the train of ignition from one barrel to another was shortened. This was about the only refinement attempted on these weapons.

The great Leonardo da Vinci (1452-1519) designed a fan-shaped affair that more than cut in half the distance between touch holes. Study of other multibarrel weapons contemplated by da Vinci shows he had in mind a way to drop the breech on the weapon for rear-end loading with some crude sort of fixed ammunition. No doubt the problem of ignition was his main stumbling block.

The first practical system of ignition was a manually applied slow-match, or fuse. A touch hole was first primed with a finely granulated powder and, when ready, the gunner made contact with the primer by using a live ember or the burning end of an impregnated piece of twisted jute. Actual fire had to be constantly present to discharge the weapon.

From the sixteenth century to 1807 was the era of the flint-lock. In most instances ignition was brought about by sharp contact of flint on steel, causing a shower of sparks to fall into a pan in which was nested the primer. Odd as it may seem, the most perfect and elaborate of these systems came first. It was made in the form of a spring-loaded wheel with a knurled edge that rested against a portion of flint or pyrite. Upon releasing the wheel the knurled edge rotated rapidly against the flint and a shower of sparks was directed into the powder train. This mode of ignition is known as the wheel-lock system.

While this method was very reliable, only the wealthy could enjoy such a contrivance. Necessity again proved to be the mother of invention. Thieves, working under cover of darkness, realized their presence would be made known by the glowing slow-match. Since they could not afford the costly wheel-lock they improvised a cheaper substitute arrangement.

A chunk of flint was held in a jaw. Upon being pulled to the rear, a horizontally placed U-shaped spring was compressed and held under tension by a notch engaging a searing device. It was released by a rearward pull on the trigger. This allowed the flint to snap smartly forward striking an inclined and pivoted piece of roughened steel. This sudden blow resulted in sparks being directed into the priming pan that was located beneath. This

system of ignition was for two hundred years known as the "Snap-hance" which, translated from the original Dutch, means "chicken thieves."

During the slow match and flintlock eras there were many peculiar designs in weapons including many proposed multi-firing devices, all attempting to solve the three major problems that confronted the inventor planning a gun. They were, first, an adequate chamber and tube to house the powder charge and direct the missile; second, some method of igniting the propellant at the instant the gunner brought the piece to bear on the target; and third, ways and means of firing successive shots with a minimum of effort and a maximum of speed.

There was also a serious effort to apply the multifire idea to shoulder arms. However, the bulk, weight and various accessories necessary for the individual soldier to suport and fire such a piece made its practical use as a weapon out of the question.

During the sixteenth century there appeared for the first time an attempt to vary the flat method of mounting the multi-barrels by placing them in a circle. Thus the idea of the revolving type of firearm came into being.

*This is the first of three articles. The next installment will trace the development of weapons from the flintlock to the metallic cartridge era.*

# THE MISSION OF MILITARY MEDICINE

REAR ADMIRAL LAMONT PUGH

MILITARY MEDICINE is conventional medicine, as circumstances in the Armed Services dictate, plus a great deal more. Fundamentally, it seeks to realize five more or less distinct but interrelated goals. Briefly stated, these goals are: selecting military personnel for service; protecting them from injury and disease; furnishing treatment when that becomes necessary; providing opportunities for professional training of medical personnel; and advancing the program of medical research.

The first of these—the selection of physically fit and psychologically adaptable personnel—is a matter of vital importance to the operating efficiency of a military organization and also to the taxpayer. Any misjudgment here can seriously hamper the efficiency of the services and add to the taxpayer's burden.

In the sphere of protection, the medical departments of the Armed Services devote much attention and effort toward preventing not only service personnel and their dependents, but civilian employees as well, from becoming ill or sustaining injuries. Witness the efforts devoted to epidemiology and hygiene. The provision of a special type of training and education with respect to the handling, preparation and serving of food, and of the sterilization and care of mess gear and related appurtenances, is of exceeding concern to the service doctor. Ashore, afloat and in the air, a program of preventive measures is in effect, ranging all the way from vaccinations and inoculations through protection against industrial hazards to the development of a bullet resistant jacket.

Our third goal actually encompasses two principles: treatment and disposition. The treatment of personnel for illness and injury when the need arises constitutes the most generally recognized role of military as well as of civilian medicine. Treatment of course covers the whole gamut of human ills, physical and mental. Nowhere is there so fertile a field for traumatic surgery

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as that provided the medical officer serving with troops in actual combat. The military surgeon holds a unique advantage in many respects. He deals with mass personnel under conditions of regimentation and in strange environments. He has the opportunity to make observations in little-known corners of the globe where he encounters unusual diseases under peculiar environmental conditions.

Disposition may, and usually does, mean return of patients to their accustomed pursuits. It may, however, call for separation by retirement or discharge from the service; in an inevitable number of instances disposition even entails care of the dead. Thus it may be said that service medicine concerns itself with the destinies of human beings from conception to resurrection.

Fourth, it devolves upon military medicine to conduct a training program to better equip its personnel for the discharge of their specialized functions and also to provide them with the opportunity of keeping abreast of their civilian colleagues. Without this opportunity the military services could not attract big league performers and without big league performers a medical department would be second rate.

Upon the fifth category, research, rests the long-range effectiveness of military medicine. Without it, the medical departments would soon decline, the interest of their medical officers would stagnate and fade, and the statures of their respective medical organizations would retrogress to that of a minor constituent of their branch of the service. Not to be overlooked, also, is the fact that civilian populations have been the lasting beneficiaries of much that has emanated from military medical research.

There is still another area in which exponents of military medicine find a singularly inviting opportunity to fulfill an exceptionally worthy mission. This potentiality does not stem from any special professional or technical ability on the part of individual service doctors but rather from advantages that accrue to them as public relations or diplomatic agents. This has sometimes been referred to as medical statesmanship.

No representatives of the medical profession are more advantageously situated or are afforded a better opportunity to bring good will to the nations of the world at less cost to the American taxpayer than are those who comprise the medical departments of our Armed Services. Particularly is this true with respect to the Navy's Medical Department since its members, in time of peace as well as war, routinely cruise to the far-flung corners of the world where they minister to representatives of foreign

governments and frequently natives of foreign countries. Also in this era of increasing diplomatic and geopolitical activity, it not infrequently devolves upon agents of the Armed Forces to provide medical care to the civilian members of various aid groups, embassies and consulates in foreign countries, in addition to their fundamental mission of caring for our uniformed personnel in those localities.

It may be well and rightly held, of course, that civilian medicine is also concerned with the same principles which are applicable to service medicine. Civilian medicine is, for example, concerned with the prevention of diseases and injury, as well as with management and cure. But seldom is it expected that a single civilian will possess an expertness in the multifarious realms that is regarded as more or less normal qualification of the service doctor.

The service doctor must possess a measure of professional versatility not ordinarily seen nor expected among civilian physicians. Among the specialties of vital import to the military and for which there is no corresponding civilian specialty, one might mention submarine medicine, aviation medicine as it relates to combat flying, and amphibious medicine. There are, in addition, broader reaches in which the service doctor may need to possess special knowledge. These would include medicine in the tropics and in frigid regions, the important aspects of protection against disaster, and its relief if it comes, the handling of mass casualties, an understanding not only of the medical but of the broader aspects of atomic energy, and of chemical and biological warfare. The matter of service doctors possessing an acquaintance with the principles and practices of logistics, particularly medical logistics, is of course of unequivocal importance. It is moreover essential that service doctors understand the fundamentals of large-scale organizational principles and how service and civilian organizations are related thereto. All of this adds up to the reality that military medicine is itself a specialty.

The service doctor must be capable of assuming the role of leader—at least by example. During my past two summers in Korea I have had opportunity to observe the mode of life and the activity of medical personnel serving with combatants in the battle zone. One would not need to remain there long to appreciate the essentiality of service doctors being psychologically agile, emotionally stable, professionally genuine and physically tough.

To be a disciple or agent of military medicine, a man must

conform to a higher order of human being. In addition to the qualities conventionally thought of as requisites of a practitioner of the healing arts, he must possess certain special attributes commonly regarded as distinctive of a statesman. In short, he must be fired with a patriotic fervor or high sense of duty, such as has impelled many members of his profession to recognize a grand and challenging opportunity for service to those who risk their lives in defense of their country .

Doctor James Markham Ambler, Passed Assistant Surgeon of the United States Navy and Medical Officer of the Arctic exploring steamer *Jeannette,* is an example of this type of medical officer. In October 1881, when offered by the captain of the ship the option of making his way to safety with certain members of the expedition or remaining behind with the starving main body, Dr. Ambler elected the latter course, and as the last words to appear in his diary he wrote, "I thought my duty required me with him [the captain] and the main body for the present." The present meant in that instance until death. In memory of this dauntless soul a tablet bearing the inscription, "Duty stronger than love of life," was placed on the wall of the library of the old Naval Medical School.

The mettle and intellect essential to the making of a doctor is such as should stand the Nation in good stead in the face of frustrating conditions. He should, by precept and example, constitute a stabilizing and salutary influence. Witness five signers of the Declaration of Independence who were physicians. If he is to be true to his national heritage, the physician must not become a convert to a creed which during recent years has made great gains in popularity and in the number of its followers, and whose motto is "security above liberty"—this, despite George Washington's warning that he who sacrifices liberty to gain security, loses both. Rather, as an adherent to the precepts of the master physician, Sir William Osler, he must subscribe to the philosophy that "medicine arose out of the primal sympathy of man with man—out of the desire to help them in sorrow, need and sickness."

# ORDNANCE SERVES BY SAVING

JAMES V. LECOCQ

ON THE SHOULDERS of the Army Ordnance Corps falls the burden of designing, producing and supplying, dollar-wise, the major portion of Army "hardware"—from tanks, guns, rockets and trucks to compasses and optical instruments.

As the largest technical service in the Army, Ordnance Corps employs more than one hundred and sixty-five thousand military and civilian personnel in its plants and depots and spends forty-five cents of every Army dollar. Currently it is placing an average of twenty thousand procurement orders a month, representing an annual expenditure of some seven billion dollars. But while billions are being spent, untold millions are being saved, largely because an economy minded, cost conscious Ordnance Corps is today carrying on a four-fold program of Standardization, Substitution, Simplification, and Salvage-Rebuild which, together, add up to Saving.

Spectacular savings have been achieved by tank and automotive standardization. An entire new fleet of tanks, trucks and other combat vehicles has been created using interchangeable parts which drastically reduce both the cost and quantity of needed stocks of spare parts. So far-reaching is the saving that the exact amount has not been calculated.

The need for such a program was recognized clearly during World War II. American industry, racing against the clock and Hitler's timetable, unleashed its productive capacity and surpassed all previous records in rolling weapons off the assembly lines. Our prime objective then was to supply our front-line troops and those of our allies with everything they needed. In the drive for all-out production, tanks were produced which were powered by as many as six different types of engines. Supply problems were enormously complicated by thousands of catalog numbers, many of which were functional duplications. Thus, while the same parts might be carried in one warehouse

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*Native laborers unload shell casings from Korean battlefields for salvage and re-use.*

U. S. Army Photograph

U. S. Army Photograph

Native laborers unload shell casings from Korean battlefields for salvage and reuse.

under different stock numbers, they could not be immediately identified as such by hard-pressed supply personnel. This in turn led to further duplication in the utilization of managerial personnel, labor, shipping facilities and warehouse space.

At the end of World War II, the Ordnance research and development budget was cut drastically—so deeply in fact that one leading automobile manufacturer had a research budget that was five times the amount Army Ordnance had available for its entire development program for tanks, trucks, tractors, self-propelled artillery and the like. Two courses were open at that time—either concentrate the bulk of available research funds on the development of major tank components, such as engines and transmissions, or build a few complete vehicles each year. Following the former course might mean that the Army, in case of emergency, would have no proven designs of complete tanks. The latter course might provide a number of complete tanks but with components incompletely developed. Since a tank is no better than its parts, it was decided to concentrate on modernizing components rather than on new but obsolescent tanks.

The wisdom of this choice was soon apparent. By the time fighting broke out in Korea, Army Ordnance had developed a completely new "power package," a standard type air-cooled engine with cross-drive transmission.

In all, there are eight engines under development, five of the large cylinder bore type and three of the smaller cylinder bore. Covering a power range from one hundred to one thousand horsepower, they are suitable for powering wheeled and tracked vehicles in the Army. Interchangeability of parts is emphasized, even between the larger and smaller cylinder engines. These units use regular 80 octane Army gasoline and are waterproofed, permitting them to run submerged for short periods. Air cooling obviates the likelihood of freeze-ups in Arctic zones. Use of these power units in Army combat vehicles promises more economical manufacture, greater reliability and easier maintenance.

Other components—including suspension and ignition systems—also had been developed to a point where they were either ready or nearly ready to put into tanks and vehicles. In the family of post-war tanks, the Walker Bulldog was the first to roll off the assembly lines. Brothers of this fast light tank include an armored personnel carrier, a cargo tractor used primarily for towing the 75-mm. Skysweeper antiaircraft gun, and four other tank-like vehicles.

Over sixty major components in this light tank family are

interchangeable, including engines, generators, torsion bars, ignition and suspension systems. The standardization program also embraces medium tanks of the General Patton type.

Today as a result of these carefully calculated decisions in the post-war years, a far different picture emerges. Whereas during World War II, six to ten different tank engines were used to power the same type tank, today eleven different vehicles are using the same power plant. World War II engines had over five thousand parts, none of which were interchangeable. In the new ones, all high mortality parts are interchangeable.

*Completely rebuilt at the Atlanta, Georgia, Army Ordnance Depot, these trucks are ready for return to duty.* U. S. Army Photograph

Standardization has paved the way for a more efficient supply and repair system. Since many vehicles now use identical parts, it is no longer necessary to buy as many varieties of spares. This in turn means reduced costs for warehousing and transportation. Fewer training schools are necessary, the instruction period for mechanics is shortened, and soldiers in rear depots can be released for duty in combat areas.

As part of its post-war standardization program, Ordnance has reduced the Army's catalog of automotive spare parts from 450,000 to 125,000. In this process, thousands of items, from cotter pins to differential gears, were examined, measured and analyzed and duplicate listings eliminated. The catalog of parts

is being further reduced by the adoption of engines which have many parts interchangeable, regardless of which company manufactures them. While the gain in efficiency and monetary savings in peacetime is appreciable, in wartime it could be decisive.

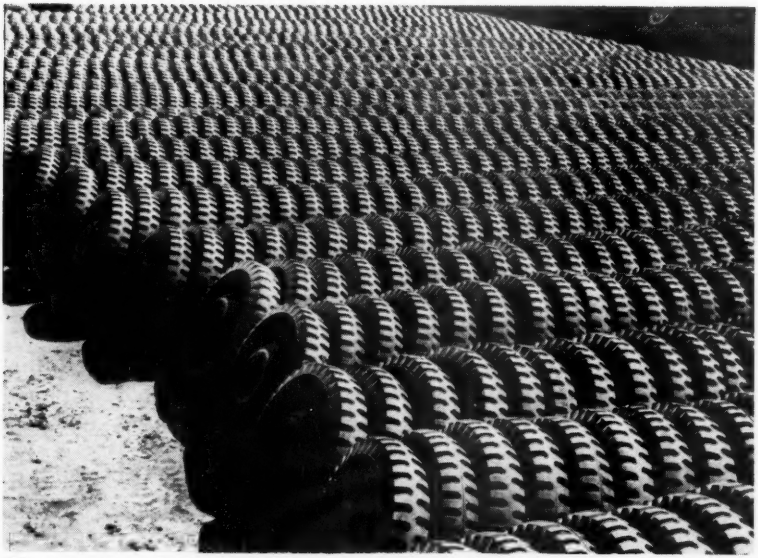
Nor have Ordnance's standardization efforts been confined to the tank and truck fields. Among the newly developed "hip pocket" artillery weapons, the 75-mm. and 105-mm. recoilless rifles use the same projectiles as the 75-mm. and 105-mm. heavy artillery pieces.

Another tremendous stride in standardization has been accomplished in the fuel and lubricant field on an international basis. Working in close co-operation with the British and the Canadians, the Ordnance Corps has tested and compared the fuels and lubricants of the three countries and listed in chart form their "acceptable" and "emergency" substitutes. Thus in Korea today an American jeep or tank out of fuel can be serviced at a British or Canadian depot. The time which this chart has saved in determining the proper fuel or lubricant—and thus assuring longer engine life—is more than enough to warrant the effort that has gone into its preparation.

Also in the lubricant field, a new all-temperature grease which functions equally well in tropic heat and Arctic cold is being adopted for use on all Army vehicles and artillery pieces. This Ordnance Corps development is expected to simplify supply problems by replacing at least six different greases; it also eliminates the necessity for a complete changeover of lubricants when automotive or artillery items are shipped to other climatic zones. The all-purpose grease is being successfully used in temperatures from −65° F. to 125° F.

Saving by substitution is being achieved by using metals and materials which are in ample supply in lieu of critically scarce items. Tests at Aberdeen Proving Ground have demonstrated that alloy steels can be substituted in certain tank and artillery components without compromising the battleworthiness of the weapon. Such substitution has saved considerable quantities of critical manganese, nickel, molybdenum and chromium. Similarly, welded steel tubing is replacing scarce seamless steel tubing in Ordnance items whenever it does not jeopardize essential military or safety characteristics. In line with this trend, Ordnance has begun manufacturing steel cartridge cases in order to conserve copper and zinc.

Still other savings are being realized by simplification of tactical vehicle specifications. The Army in World War II



*These renovated tires and wheels are sufficient for only one day's output of trucks at an Ordnance repair shop in Japan.* U. S. Army Photograph

used twenty-eight basic vehicles comprising eighteen different engines, nineteen transmissions, twenty-one front axles, sixteen rear axles and thirteen tire sizes. Today, this fleet has been reduced to only seven types, and the number of component types likewise has been reduced to seven. Basic chassis designs have been simplified, generally following the pattern of commercial vehicles currently in production at various truck plants.

While combat vehicles necessarily require rugged construction, design specifications have been simplified to achieve savings which in no way impair military effectiveness. By reducing the requirement for deep fording of streams to a shallower, thirty-inch depth, it was possible to eliminate certain types of waterproofing for trucks of one-quarter to five-ton capacity. Other changes included relaxation of specifications for radio static suppression features—a factor not always important in certain vehicles. These and other changes are expected to produce a thirty-two million dollar saving on equipment being produced under current contracts.

As part of a continuing program of salvage and repair, vast amounts of Ordnance materiel left over from World War II have been made available for combat use. Operation Rollup, launched in 1948, salvaged enormous quantities of Ordnance

materiel that had been abandoned on the atolls and islands of the Pacific. In the base industrial group's automotive rebuild shops in Japan, known as the Big 5, mountains of parts and supplies have been salvaged from the junk heap. Vehicles costing $7000 new have been rebuilt for as little as $1000. (See "Men and Machines in Occupied Japan," June 1950 DIGEST.)

This salvaged material enabled us to supply the United Nations forces in Korea with 84 percent of their general purpose vehicles, 38 percent of their tanks, 68 percent of their artillery and 70 percent of their infantry weapons. An estimated 65 percent of all transport vehicles hauling ammunition, rations and mail to the fighting forces in Korea have been processed through these rebuild plants. The importance of these supplies to the forces in Korea cannot be over-emphasized, and the savings in equipment costs and in transportation from the United States can be measured in billions of dollars.

Also as a part of its salvage drive, the Army is making a determined effort to collect all reclaimable materiel, even at the front. Knocked-out enemy tanks and discarded shell cases are salvaged for scrap metal. For nearly two years the Ordnance Corps has been supplying more than 75 percent of its own requirements for brass and other non-ferrous metals by re-using metal from obsolete and deteriorated ammunition, and from cartridge cases salvaged in Korean battle zones. Even after deducting reclamation costs, savings run to an estimated three million dollars monthly on brass recovery alone. In Europe, too, a program known as Triple R—Rebuild, Repair and Recovery—is making the most of available materiel. (See "Triple R Helps EUCOM Pay Its Way," October 1949 DIGEST.)

While the Ordnance program of Standardization, Simplification, Substitution and Salvage-Rebuild takes many forms, it is essentially the application of good management principles to everyday operations. Good management means thrifty control and administration. As Major General E. L. Ford, Army Chief of Ordnance, has declared, "we are practicing good management when we engage in our program of standardization of vehicles and equipment, when we attempt to repair and rebuild all the equipment for which there is a potential need, when we engage in salvage operations to reclaim materials for re-use, and sell that which is otherwise waste. In brief, anything we can do to cut costs yet increase quality contributes to good management and thereby to the national security."

# PUBLIC OPINION AND AIR FORCE DOLLARS

LIEUTENANT GENERAL EDWIN W. RAWLINGS

THE AIR FORCE today faces a special problem in public relations, mainly because a significant portion of the American public has some misconceptions about the dollar cost of airpower. These misconceptions, if allowed to continue, could cost the Air Force the valuable support of the public in building toward adequate air protection.

Much public thinking follows a pattern something like this: Taxes hurt; therefore, let us examine the importance of air power which accounts for such a large share of the tax dollar. Apparently, air power has not won a victory in Korea, yet it is costing billions and the end in dollars is not in sight.

The tendency to raise questions concerning the high cost of air power today cannot be dismissed merely as immature and unsound thinking. If the defenses of our Nation are to be strong, the public thinking about defense costs must be informed and mature. It should be universally understood that our defense program is grim business, and the stakes are national survival.

Many Americans, however, do not fully understand the basic concept of strategic air power which makes our expensive bomber fleet a necessity for survival in today's air age. We must get down to cases in explaining to the public the *whys* of range, altitude and bomb load which are consuming billions of dollars in this life and death race.

If those of us in the Air Force have not done this information job as thoroughly as we might in the past, it is because we were inclined to accept these facts as self-evident as a result of our daily association with them. But the public, which pays the bill, must be told the reasons for the bigness and the need for increased numbers of planes with improved bomb load and higher altitude range.

We must explain—concretely, simply and honestly, wherever

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and whenever we can—*why* modern air power costs as much as it does. The average citizen, buffeted on all sides by rising costs, is irritated and suspicious in the face of big, vague economic factors which cut into his buying power. It is difficult enough for him to accept a high price tag on items familiar and immediately useful to him. It is almost impossible for him to realize without explanation why a piece of electronic equipment about the size of his television set costs $80,000 or why a bomb sight which weighs less than his automobile is priced at $200,000. He does not immediately comprehend the research and engineering that has gone into such equipment, the special tooling, the high-priced man-hours expended in its development.

The great increases in speed, altitude, range and mission capabilities of our planes which have resulted from the technological revolution since World War II have only been won at a price. As the machines have become more complex and more efficient, our research, engineering, tooling and production costs have risen and the time interval between design and flight has doubled and tripled. Today's fighter requires more than one million engineering man-hours of direct labor. The figure for a bomber is close to three and a half million hours. Wind tunnel research time on the B-47 jet bomber was 6200 hours, as compared to 248 hours required for the B-17 of World War II.

To achieve the speeds and withstand the stresses of supersonic flight we must use new and stronger materials in better ways and machine them with almost watch-like precision. A typical fighter airframe requires eighteen thousand separate and distinct types and kinds of materials. The six thousand bolt holes in the B-47 wing must be accurate within one- to two-thousandths of an inch, less than the thickness of a human hair.

We are making progress in devising methods by which this kind of custom-made air power can be produced in quantity. At the end of 1952 our aircraft production was nearly seven times what it was in July 1950. But we are still a very long way from being able to turn out planes as we do refrigerators or automobiles in the standardized mass quantities that would radically cut costs. Moreover, since present-day air power is a race for quality as well as quantity and is based on a complex and rapidly changing technology, mass production itself offers no cure-all solution to the cost problem.

Added to the expense inherent in the *kind* of air power we are building are today's rising costs of everything from labor to lug nuts. In short, we must face up to the fact that we cannot

buy modern air power at horse and buggy prices. That is the first inescapable reality of our job which we must understand.

But, some on the sidelines contend, can't we perhaps do with less of this expensive air power? As you know, we are aiming for a strength of 143 wings by 1955. This estimate is based upon our knowledge of the air power now being mounted by the Communists and the competition we may have to meet to defend ourselves. These 143 wings will not give us numerical superiority. They represent the absolute minimum strength which will insure our survival if we can retain an edge of superior quality. It is less than ideal and will be achieved later than Air Force leaders would have wished had there been any practical alternative. We cannot reduce this goal without actual danger to the national security. That is a hard fact which shapes our planning.

It is our job to tell the citizen that side of the story. We must break down the separate elements of aircraft cost and show where raw materials, labor, engineering skills and plant facilities add to the expense. We must show that we are working for economy even within these high price areas. We must show that we have eliminated waste.

Let us concentrate on showing the public just where the Air Force dollars go. Let us state clearly and honestly some of the hard facts of life which must prevail in a democracy arming for its survival.

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When we save dollars and resources we contribute as much to the defense of our way of life as if we had fired a shot on the battlefield in defense against Communist aggression.

*General J. Lawton Collins*

# WHAT'S YOUR SERVICE NUMBER?

MAJOR THOMAS A. ENLOE

THOUGH NO ONE has ever proposed a monument in his honor, retired Master Sergeant Arthur B. Crean of Portland, Oregon, holds a unique distinction in Army records which no other man ever will duplicate. Numerically speaking, he is the Nation's first soldier. Out of some fifty-eight million assigned and unassigned service numbers, he has ASN 1. By contrast, Private Fadrique Garcia carries ASN 58,410,043.

Today "What's your service number?" along with "What's your name?" are probably the most asked questions in the Army. Actually, from an official point of view, the proper answer to the second question includes the answer to the first because once a man comes into the Army his official name and his service number are one and inseparable.

The soldier's service number is a row of anywhere from one to eight digits sometimes combined with one or two initials. It is an integral part of his name which he quickly learns to roll off his tongue in the same glib way that he announces his given name, middle initial and family name. It is one of the things which he learns very early in his Army career and which he never forgets. And, surprisingly enough, it is quite apt to be the only thing in his entire military service—be it long or short—which is unchanging. Militarily speaking, the service number is as positive, as personal and usually as unchanging as one's thumbprints. No one else has ever had it; no one else ever will.

Few men in the service today can remember when they did not have a service number (formerly known as a "serial" number), but before 28 February 1918, no one had a number. The idea of assigning each individual an identifying symbol had been considered as far back as 1898, but it was not until General of the Armies John J. Pershing, then commanding the American Expeditionary Forces in France, made an urgent recommendation to The Adjutant General that such action was taken.

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By that time AEF field clerks were swamped with dozens of mistaken identity cases arising from similar names. In an Army swollen into the millions, there was bound to be a problem in differentiating among the many John Joneses and William Browns on the rolls. "To prevent confusion and errors, especially in the case of casualties," General Pershing cabled, "it is believed necessary to adopt a system of numbers."

Others were also asking for a similar system. The Surgeon General recommended to the Chief of Staff that "a numbering system be adopted at once or as early as practical." The Quartermaster General agreed, pointing out that it had "also recently strongly advocated orally the adoption of such a system."

Soon afterward a plan to give enlisted men service numbers went into effect. Preparatory instructions with blocks of numbers running from 1 to 6,000,000 went out to the various commands. Instructions to the General Recruiting Service described the procedure: "Assignment of numbers will be made as of 28 February 1918 and each man in the service will be assigned a number by his commanding officer from the block of numbers assigned by the Department Commander.* To each man subsequently entering the service, a number will be assigned by the recruiting or other proper officer. . . ."

Numbers initially set aside for enlisted men ran up to the number 6,000,000. Effective 6 March 1919, blocks of numbers starting at 6,000,001 were assigned and so it has gone.

Sergeant Crean and nine others who share in his administrative stroke of fate happened to be in the right place at the right time. They were in Pershing's headquarters which had received the block of numbers from 1 to 300,000. Sergeant Crean was then on duty in the Surgeon General's Office, Headquarters, American Expeditionary Forces. Right behind Crean came James K. Skelly, ASN 2; Adelbert C. Callaway, ASN 3; Jacob Dokker, ASN 4; William E. Engel, ASN 5; William J. Fenton, ASN 6; Philip Gordon, ASN 7; Harry C. Hanford, ASN 8; Milton F. Henry, ASN 9; and Allen Hull, ASN 10.

Once a soldier received his number it stuck with him for all time. World War I veterans who reenlisted later received their old numbers again, the only change being the prefix R. Today Army Regulation 615-30 states emphatically, "The service number originally and properly assigned to an enlisted person will not, under any circumstances, be assigned to another indi-

*At this time, the Army was organized in geographical "Departments" generally comparable to today's Army Areas.

vidual. It will continue to be his number throughout his enlisted service in the Army or Air Force."

It may come as a surprise to some, but one's service number is more important than his name to the Army. Army Regulations state that it is the most "essential part of his official identification." Wherever the individual's name appears in letters, telegrams, orders, reports, payrolls and other Army records, so must his service number. It always precedes his grade, organization and arm or service. In fact, many financial accounts are paid by service number rather than by name. Should his relatives write letters of inquiry about him to the Army, it is important that they give his correct service number. Without it, the Army may find it difficult, if not temporarily impossible, to provide the information they seek.

Once the idea of numbers was established, it spread to wider fields. Today almost everything and everybody in the Army has a number, from mules, horses, rifles, pistols to French horns.

For reasons which the record does not show, no action toward assigning numbers to officers came until 1921. On 2 June of that year it was directed that numbers from 0-1 to O-100,000 be assigned or set aside for Regular Army officers and numbers starting with O-100,001 for Reserve officers. Subsequently this latter group was further broken down by assigning to Army nurses numbers starting at 700,001 with a prefix N, and numbers starting at 900,001 with a prefix W to Warrant Officers. Later, when the status of Army Field Clerks was abolished, many of its members became Warrant Officers and retained their numbers in the 800,000 series, merely changing the prefix from F to W.

Today a set of alphabetical prefixes designates the different categories of enlisted personnel. The letter A identifies AUS (Army of the United States) enlisted women; RA, Regular Army enlisted men; ER, male enlisted reservists on active duty; NG, National Guard enlisted men on active duty; AD, aviation cadets; AF, airmen; and AA, Air Force enlisted women. For the period from 1 June 1945 to 17 July 1947, the prefix RA was used to designate men who enlisted or reenlisted in the Regular Army. For officers, the prefix O designates male officers while L denotes members of the Women's Army Corps.

In assigning numbers, every effort is made to prevent duplication and error. The Adjutant General continues to allot numbers by blocks to Army commanders in the United States and overseas, who in turn allocate the numbers to stations and units

in their commands. As each new recruit or inductee receives his number, a report is filed with The Adjutant General in Washington, where each man's name and number are double-checked for accuracy. Occasionally mistakes are found. Then one of the numbers must be cancelled and a new one assigned in its place.

Though no two individuals may share the same number, an individual may acquire more than one service number during his career. For example, an enlisted man who becomes a warrant officer receives a second number. Should he later become a commissioned Reserve officer, he receives still a third number. Finally, if he decides to make the Army his career and becomes a Regular Army officer, he ends up with a fourth number. When asked, "What's your service number?" he properly answers with the number pertaining to his latest status, though the other numbers still remain in his records.

No matter where a man joins the service, the Army must first provide him with a number. During World War II American units in out of the way spots around the world found Americans coming into camp to enlist. Authority was granted a unit in New Delhi, India, for example, to appoint a total of one hundred and fifty officers and enlist two hundred men. An appropriate block of service numbers went along with the authorization.

Service numbers linked with famous names include General Pershing, who was Chief of Staff when the first officer numbers were assigned and who received O-1. Major Generals Leonard Wood and Hunter Liggett were next in line with O-2 and O-3. General Douglas MacArthur can boast of a low O-57 among contemporaries like General George C. Marshall, O-1616, General Jonathan M. Wainwright, O-2131 and General Omar N. Bradley O-3807. President Dwight D. Eisenhower's military records are replete with the number O-3822. Colonel Harry S. Truman answers to O-129869.

While the day of distinctively low numbers is in the past, each individual has his own to memorize, keep well stamped on his personal belongings and circulate to his relatives and correspondents. In this way he may be unmistakably identified despite changing assignments and transfers to duty stations around the world.

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